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## WATERSHED WORK PLAN

# FIRST CAPITOL WATERSHED

### LAFAYETTE AND IOWA COUNTIES, WISCONSIN



U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Prepared under the authority of the Watershed Protection & Flood Prevention Act  
(Public Law 566, 83rd. Congress, 68 Stat, 666) as amended.

JUNE 1974

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FIRST CAPITOL WATERSHED

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Wisconsin

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WATERSHED WORK PLAN ADDENDUM

U.S. Department of Agriculture

Soil Conservation Service

Prepared in Fulfillment of the Interim Requirements for  
Principles and Standards for Planning Water and Related Land

Resources Established Pursuant to Sec. 103 of the Water

Resources Planning Act (Public Law 89-80)

August 1974



### Introduction

This addendum is based on the Principles and Standards for Planning Water and Related Land Resources as developed by the Water Resources Council.

The First Capitol watershed work plan is based on 1972 prices and a  $5\frac{1}{2}$  percent interest rate. The addendum has been prepared to show the effects of a  $5\frac{7}{8}$  percent interest rate, current (1974) installation costs, and current normalized prices.

The alternative selected for implementation, as contained in the work plan, is based on a careful and deliberate consideration of the environmental and economic impacts of the project. No known unresolved environmental issues exist. The final environmental impact statement has been modified in response to comments.

Effects resulting from evaluation of the selected plan are displayed under separate accounts for national economic development, regional development, environmental quality, and social well-being.

This watershed work plan addendum for phase-in of principles and standards is composed of three sections as follows:

- I. The effects of a  $5\frac{7}{8}$  percent interest rate, current installation costs, and current normalized prices.
- II. An abbreviated environmental quality plan consistent with the principles and standards to show environmental quality problems, component needs, plan elements, effects, and institutional arrangements.
- III. A display of the four accounts-national economic development, regional development, social well-being, and environmental quality-which show the impacts of the selected plan.

## SECTION I

### BENEFIT-COST RELATIONSHIP

Project costs, benefits, and benefit-cost ratio based on a 5 7/8 percent interest rate, 1974 installation costs, and current normalized prices are as follows:

1. Project costs are \$55,270.
2. Project benefits are \$73,790.
3. The project benefit-cost ratio is 1.3 to 1.0.

## SECTION II

### ABBREVIATED ENVIRONMENTAL QUALITY PLAN

#### ENVIRONMENTAL QUALITY OBJECTIVE

The environmental quality objective of the First Capitol watershed is to manage, conserve, preserve, create, restore, and enhance the quality of the environment.

#### ENVIRONMENTAL PROBLEMS

##### Land and Water Quality

Important problems resulting from lack of proper land treatment in the First Capitol watershed include: sheet, gully, and streambank erosion; surface runoff; and improper woodland and pasture management.

Sheet erosion in the upland is excessive. Unwise land use and poor management are allowing this soil resource to deteriorate. Approximately 46 percent of the upland cropland needs protection from erosion. Approximately 20 percent of the upland pasture is poorly managed. Most of the upland forest cover is in poor hydrologic condition.

Upland sheet erosion in the watershed is the most serious form of erosion in terms of tons of soil loss. Some cropland is currently contributing up to 16 tons per acre per year. The watershed average for cropland is about 5.8 tons per acre per year. Sheet erosion losses on grassland is estimated at 0.5 ton per acre per year or less. Average losses on forest land is 0.16 tons per acre per year. Gully, roadside, and streambank erosion also reduce the esthetic and functional qualities of the land resource.

Erosion reduces fertility and shortens the productive life of agricultural lands.

Sediment deposited by floodwater causes crop damage and decreases water infiltration. Sediment is transported by water and deposited in the stream system. Approximately 14.4 acre-feet of sediment is delivered annually to the Pecatonica River. Organic and inorganic

nutrients enter the stream system in association with sediment. Chemical pollutants also impair water quality. Periodic barnyard runoff contributes nutrients and impairs biological water quality.

### Biological Resources

Competition for land uses has resulted in wildlife habitat losses. The continuing development of roads, highways, and residential areas contribute to this problem.

The destruction of farm and roadside hedgerows has reduced prime habitat for a number of species. Lack of prime habitat limits the potential numbers and distribution of upland wildlife species. Additional habitat for nesting and cover is needed to increase wildlife populations.

Woodland stands have relatively low site quality. Grazing and sheltering is common in many of the stands with resulting soil compaction and loss of litter and humus.

The scarcity of trees and shrubs within the watershed provides little cover for various wildlife species. This lack of winter protection can result in high wildlife losses, particularly to game birds, during severe winters.

Environmental losses occur on flood plains where wildlife feeding and nesting areas are damaged by frequent flooding. Sediment deposition in the streams is destroying fish habitat.

Streambank erosion caused by flooding and accelerated by livestock is a serious threat to aquatic habitat. Agricultural use of the watershed has accelerated runoff and decreased the number of resting areas, the amount of food supply, and spawning areas for game fish.

Water within the watershed is limited to a 55-acre private lake, 11 farm ponds, a few small oxbow lakes, and the stream system. Suitable habitat for aquatic wildlife is extremely limited.

### COMPONENT NEEDS

1. Preserve land quality by better control of gross erosion.
2. Improve water quality by better management practices.
3. Maintain and improve upland wildlife habitat.



4. Protect wildlife habitat on flood plains and stream fishery habitat.
5. Create additional wetlands for aquatic wildlife.
6. Manage and enhance wildlife resources.

#### PLAN ELEMENTS

1. Install land treatment measures on 10,000 acres of cropland. These measures may include, but would not be limited to; conservation cropping systems, contour farming, critical area planting, diversions, grade stabilization structures, grassed waterways and outlets, minimum tillage, hayland planting, stripcropping, terraces, and tree planting. Estimated costs for land treatment measures on cropland is \$188,600.
2. Improve 6,000 acres of grassland with better management and treatment practices such as proper grazing use, and planned grazing systems. In addition, pasture seeding is needed to improve pastures in poor condition and formerly cultivated fields. Further improvements can be attained through proper distribution of livestock grazing. Estimated total costs are \$126,700.
3. Apply management and appropriate land treatment measures on 1,500 acres of forest land. This will principally involve the control of forest land grazing, tree planting, and various cultural practices. Marking stands for improvement is a recommended practice for achieving multiple use-sustained yield management on forest lands. Estimated cost for establishing these practices is \$55,800.
4. Protect all class VI and class VII land with permanent vegetation, including grass and trees. Approximately 60 acres of class VI and class VII land will be reforested. An additional 500 acres of class II, III, and IV lands with critical erosion problems will be converted to forest vegetation. Estimated cost is \$45,000.
5. Establish wildlife habitat improvement and management to provide additional food and cover. Reserve 2 acres per square mile throughout the watershed for exclusive wildlife use. These should be 1-to 2-acre plots protected from livestock use. These approximate 160 acres are expected to cost \$80,000.



6. Stabilize streambanks along 15 miles of channel by sloping and seeding, rip-rapping, and fencing to exclude livestock. Estimated cost is \$350,000.
7. Install instream devices to improve trout habitat along 2 miles of Jones Branch. These improvements may include, but would not be limited to; bank cover, boulder retards, stump cover, wing deflectors, spawning areas, and cattle crossings. Estimated cost is \$10,000.
8. Install instream devices to improve smallmouth bass stream habitat along 5 miles of Bonner Branch and 3 miles of Cottage Inn Branch. These improvements, which would be similar to the trout stream devices, would cost approximately \$42,000.
9. Create additional wetland by installing 50 surface water areas. These can be shallow water developments or farm ponds. Expected cost is \$150,000.

Total installation cost of all nine plan elements is \$1,048,100.

#### INSTITUTIONAL ARRANGEMENTS

Educational and research functions are available from the Extension Service of the University of Wisconsin. They can conduct research and provide information useful in all phases of the environmental quality plan.

The Forest Service can provide technical assistance for forest land treatment measures to be installed by landowners through a cooperative agreement with the Wisconsin Department of Natural Resources, Bureau of Forest Management.

Technical assistance for the application of land treatment measures on cropland, grassland, and other land can be obtained from the Soil Conservation Service.

Federal cost-sharing assistance to individual landowners for applying approved conservation practices may be provided by the Agricultural Stabilization and Conservation Service.

Farmers Home Administration, local banks, and other lending agencies have funds available for lending at various interest rates that can be used for most plan elements. Local landowners and operators as well as local groups and organizations can furnish labor, land, and financial assistance toward the implementation of plan elements. Other funds may be obtained from various sources such as public law 83-566, Outdoor Recreation Assistance Program, county and other local funds.

The Wisconsin Department of Natural Resources can furnish information and technical assistance regarding biological needs especially in areas of fish and wildlife.

The Lafayette and Iowa County Soil and Water Conservation Districts can furnish information, technical assistance, and financial assistance toward fulfilling plan elements.

## EFFECTS

1. Conservation land treatment will increase water intake rates of the soil thus reducing rainfall runoff, erosion of land, sediment deposition in streams, and flood damages while at the same time increasing vegetation growth.
2. Gross erosion rates will be reduced by more than 50 percent.
3. Grassland and forest land management practices will enhance wildlife values and contribute substantially to beautification, esthetic appeal, and environmental quality.
4. Wildlife habitat improvement practices will increase the availability of food and cover resulting in increased wildlife populations.
5. Streambank stabilization will reduce bank erosion and improve water quality of the streams.
6. Stream improvement features will improve the fishery resource.

7. Additional wetlands will create aquatic habitat for a large variety of wildlife species.
8. Managing the land resource within its capability and allowing critical areas to remain in permanent vegetative cover will provide additional areas of natural beauty, in addition to protecting the environment.
9. Taken as a whole, the plan elements will improve environmental quality of the entire area for all living things.

### SECTION III

#### ACCOUNTS DISPLAY

Display accounts for national economic development, regional development, environmental quality, and social well-being are shown as measures of effects of the selected plan. The national economic development account and the regional development account measures have both beneficial and adverse effects. The environmental quality account and the social well-being account do not differentiate between beneficial and adverse effects.

The regional development account compares the State of Wisconsin and the rest of the Nation in their relationship between beneficial and adverse effects.

All four accounts developed for the selected plan use existing supporting data from the work plan to develop the display tables.

# SELECTED PLAN

## NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

First Capitol watershed, Wisconsin

Components	Measures of Effects (Average Annual) 1/	Components	Measures of Effects (Average Annual) 1/
------------	--	------------	--

### Beneficial Effects:

A. The value to users of increased outputs of goods and services

1. Flood prevention
2. Recreation
3. Changed land use

\$ 44,820  
6,200  
2,120

Total beneficial effects

53,140

### Adverse Effects:

A. The value of resources required for a plan

1. Floodwater retarding structures and smallmouth bass stream improvement

\$ 37,960  
4,560  
3,110

Project installation  
Project administration  
O&M&R

Total adverse effects

45,630

Net beneficial effects

7,510

1/ 100 years @ 5 1/2 percent interest.

SELECTED PLAN  
ENVIRONMENTAL QUALITY ACCOUNT

First Capitol watershed, Wisconsin

<u>Components</u>		<u>Measures of Effects</u>	<u>Components (Con't)</u>	<u>Measures of Effects (Con't)</u>
Beneficial and adverse effects:				
A. Areas of natural beauty		1. Reduction of floodwater and sediment damage will provide opportunity for improvement of rural and urban property.		2. Enhance habitat and food supply for big game animals and game and nongame birds on 11,610 acres.
		2. Create lake with 18 surface acres with 0.8 miles of shoreline.		3. Provide 18-acre resting area at the reservoir for migratory waterfowl.
		3. Inundate 18 acres of grassland along 0.5-mile stretch of stream.		
		4. Acres of land flooded by the 100-year frequency storm will be reduced from 1,600 to 1,295.		
B. Quality considerations of water, land, and air resources		1. Cropland sheet and gully erosion will be reduced from 5.8 to 3.5 tons per acre per year on the uplands from land treatment measures.	D. Irreversible or irretrievable commitments	1. Conversion of 177 acres of agricultural land to dams, spillways, and sediment pools.
		2. Reduce erosion on 11,610 acres of cropland, grassland, and forest.		
		3. Air pollution will be increased slightly during the project construction period.		
C. Biological resources and selected ecosystems		1. Create habitat for bass stream fishing to accommodate 2,070 fisherman days.		



SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT

First Capitol watershed, Wisconsin

<u>Components</u>		<u>Measures of Effects</u>		<u>Components</u>		<u>Measures of Effects</u>	
		State of	Rest of			State of	Rest of
		Wisconsin	Nation			Wisconsin	Nation
		(Average Annual)	1/			(Average Annual)	1/
A. Income:				A. Income:			
Beneficial Effects:				Adverse Effects:			
1.	The value of increased output of goods and services to users residing in the region			1.	The value of resources contributed from within the region to achieve the outputs		
a.	Flood prevention	\$ 44,820		a.	Floodwater retarding structures and recreational facilities	\$ 7,580	\$30,389
b.	Recreation	6,200			Project installation	580	3,980
c.	Changed land use	2,120			Project administration	3,110	0
					OM&R		
2.	Secondary	5,700					
Total beneficial effects		58,840		Total adverse effects		11,270	34,369
				Net beneficial effects		47,570	-34,369

1/ 100 years @ 5 1/2 percent interest



# SELECTED PLAN

## REGIONAL DEVELOPMENT ACCOUNT

First Capitol watershed, Wisconsin

Measures of Effects	
State of Wisconsin	Rest of Nation

### Components

#### B. Employment

#### Adverse Effects:

1. Decrease in number and types of jobs

Total adverse effects

Net beneficial effects

8.4 permanent semiskilled jobs

23 semiskilled jobs for 1 year

### Measures of Effects

State of Wisconsin	Rest of Nation
--------------------	----------------

### Components

#### B. Employment

#### Beneficial Effects:

1. Increase in number and types of jobs

a. Employment for project construction 23 semiskilled jobs for 1 year

b. Employment for OM&R 0.4 permanent semiskilled jobs

c. Indirect and induced employment for project installation and output of project's goods and services 8 permanent semiskilled jobs

Total beneficial effects

8.4 permanent semiskilled jobs

23 semiskilled jobs for 1 year

# SELECTED PLAN

## REGIONAL DEVELOPMENT ACCOUNT

First Capitol watershed, Wisconsin

### Measures of Effects

<u>State of Wisconsin</u>	<u>Rest of Nation</u>
---------------------------	-----------------------

### Components

#### C. Population Distribution Beneficial Effects:

The project will create 8.4 permanent semiskilled jobs and 23 short-term semiskilled jobs in an area where 13.4 percent of the families have incomes less than the national poverty level. This project is located in an area where approximately 44 percent of the labor force is employed in agriculture as compared to 11 percent in the rest of the state.

#### Adverse Effects:

#### D. Regional Economic Base and Stability

#### Beneficial Effects:

The project will provide flood protection to a 1,600-acre flood plain in an area where agriculture is the primary economic base. It will provide protection to an estimated 74 homes and businesses with an estimated value of \$4,870,000.

#### Adverse Effects:

SOCIAL WELL-BEING

First Capitol watershed, Wisconsin

<u>Components</u>		<u>Measures of Effects</u>	<u>Components</u>	<u>Measures of Effects</u>																				
Beneficial and Adverse Effects:																								
A. Real income distribution	1.	Create 8.4 low to medium income permanent jobs for area residents	B. Life, health, and safety	1. Future threats of flood loss will be reduced. The project will provide benefits to 74 residential and business properties in the urban area of Darlington. Reduction in depth of flooding will reduce threat of damage to 12 road and bridge locations and a 1,600 acre flood plain.																				
	2.	Create regional income benefit distribution of \$44,820 annual flood damage reduction benefits by income class as follows:																						
		<table><tr><th colspan="2">Percentage</th><th colspan="2">Percentage</th></tr><tr><th>Income Class (Dollars)</th><th>of Adjusted Gross Income</th><th>Income Class</th><th>Benefits In Class</th></tr><tr><td>Less than 3,000</td><td>11</td><td>Less than 3,000</td><td>2</td></tr><tr><td>3,000-10,000</td><td>58</td><td>3,000-10,000</td><td>40</td></tr><tr><td>More than 10,000</td><td>31</td><td>More than 10,000</td><td>58</td></tr></table>	Percentage		Percentage		Income Class (Dollars)	of Adjusted Gross Income	Income Class	Benefits In Class	Less than 3,000	11	Less than 3,000	2	3,000-10,000	58	3,000-10,000	40	More than 10,000	31	More than 10,000	58	C. Recreational opportunities	1. Create 2,070 recreational visitor-day activities primarily for a rural farm population
Percentage		Percentage																						
Income Class (Dollars)	of Adjusted Gross Income	Income Class	Benefits In Class																					
Less than 3,000	11	Less than 3,000	2																					
3,000-10,000	58	3,000-10,000	40																					
More than 10,000	31	More than 10,000	58																					

3. Local costs to be borne by region total \$11,270 annually with distribution by income class as follows:

Percentage		Percentage	
Income Class (Dollars)	of Adjusted Gross Income	Income Class (Dollars)	of Adjusted Gross Income
	In Class		In Class
Less than 3,000	11	Less than 3,000	2
3,000-10,000	58	3,000-10,000	40
More than 10,000	31	More than 10,000	58



# *Watershed Work Plan*

## *First Capitol Watershed*

LAFAYETTE AND IOWA COUNTIES,  
WISCONSIN

Prepared Under the Authority of the Watershed  
Protection and Flood Prevention Act (Public Law 566,  
83rd Congress, 68 Stat. 666), as amended

Prepared by  
Lafayette County Soil and Water Conservation District

With Assistance By  
U.S. Department of Agriculture, Soil Conservation Service  
U.S. Department of Agriculture, Forest Service  
U.S. Department of the Interior, Fish and Wildlife Service  
State of Wisconsin Board of Soil and Water Conservation Districts  
First Capitol Watershed Association  
Wisconsin Department of Natural Resources  
University of Wisconsin Extension

JUNE 1974



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# WATERSHED WORK PLAN AGREEMENT

between the

Lafayette County Soil and Water Conservation District  
(hereinafter referred to as the Sponsoring Local Organization)

State of Wisconsin

and the

Soil Conservation Service  
United States Department of Agriculture  
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the First Capitol Watershed, State of Wisconsin, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the First Capitol Watershed, State of Wisconsin, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire , with other than P.L. 566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost \$106,900) .
  
2. The Sponsoring Local Organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (Percent)	<u>Service</u> (Percent)	<u>Estimated 1/ Relocation Payment Costs</u> (Dollars)
Relocation Payments	32.9	67.1	\$0.00

- 1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.
  
3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.



4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Small Mouth Bass Stream Improvement	50.0	50.0	\$55,200
Single Purpose Flood Retarding Structures	0	100.0	\$476,000

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
Small Mouth Bass Stream Improve- ment	100.00	0	\$ 2,760
Single Purpose Flood Retarding Structures	0	100.00	\$46,190

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$10,620 and \$71,950 respectively.

7. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangement and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.



14. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all the requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.
16. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

LAFAYETTE COUNTY SOIL AND WATER CONSERVATION DISTRICT

By Byron Berg  
Title Chairman

Address Route 2, Blanchardville, Wisconsin 53516  
Zip Code

Date May 21 1973

The signing of this agreement was authorized by a resolution of the governing body of the Lafayette County Soil and Water Conservation District adopted at a meeting held on May 21 1973.

Richard McKnight  
(Secretary, Lafayette County Soil and Water Conservation District)

Address Route 1, South Wayne, Wisconsin 53587  
Zip Code

Date May 21 1973

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service  
United States Department of Agriculture

By \_\_\_\_\_

Date \_\_\_\_\_

# Watershed Work Plan

## First Capitol Watershed

LAFAYETTE AND IOWA COUNTIES,  
WISCONSIN

JUNE 1974

### SUMMARY OF PLAN

The First Capitol Watershed has a drainage area of 52,198 acres or 81.6 square miles of which 52,064 acres are located in northwestern Lafayette County and 134 acres on the southwestern edge of Iowa County.

The Lafayette County Soil and Water Conservation District, sponsoring local organization, directed the preparation of this work plan. The First Capitol Watershed Association, though not a sponsor, contributed significantly to its preparation. Technical assistance was provided by the Soil Conservation Service and the Forest Service of the U.S. Department of Agriculture. Other contributing agencies include the Wisconsin State Board of Soil and Water Conservation Districts, the Wisconsin Department of Natural Resources, the University of Wisconsin Extension, and the Fish and Wildlife Service of the U.S. Department of Interior.

Frequent and severe floodwater damage is the principal problem in the First Capitol Watershed. Floodwaters have destroyed crops and pasture; drowned livestock; damaged equipment; washed out roads, bridges, and fences; delayed plantings; hindered harvest operations; depressed crop yields; and, deposited debris on crop and pasture land. Additional agricultural and urban damages have occurred along the Pecatonica River and in the city of Darlington which is immediately adjacent to and below the watershed.

-Summary-

Land treatment measures on the uplands will reduce cropland sheet and gully erosion by about 2.3 tons per acre per year. Increased infiltration potential will decrease run-off from smaller more frequent storms. Structural works of improvement will reduce floodwater and related sediment damages to agricultural and nonagricultural properties by approximately 67 percent in the benefited area of the watershed. Damages to the city of Darlington and the Pecatonica River flood plain outside of the watershed will be reduced by an estimated 11 percent.

The few small lakes in the area do not satisfy the demand for public water-based recreation. Except for incidental recreation, this work plan includes no recreational facilities. A multiple purpose structure site was investigated and planned but was eliminated by the sponsoring local organization on the basis of local opposition.

Works of improvement proposed in this plan include land treatment and structural measures. The total project installation cost is estimated to be \$1,002,210, of which \$232,590 is for land treatment and \$769,620 is for structural measures.

The proposed land treatment measures to be applied on 11,610 acres include: conservation cropping system, contour farming, control of woodland grazing, critical area planting, diversion, grade stabilization structure, grassed waterway and outlet, minimum tillage, pasture and hayland planting, streambank protection, strip cropping, terraces, tree planting, and wildlife habitat improvement and management.

The installation cost to landowners for land treatment is estimated to be \$166,900. The cost of technical assistance for planning and applying land treatment measures is estimated to be \$65,690; \$50,670 of which will be P.L. 566 funds to support accelerated land treatment, and \$15,020 of which will be provided by the Soil Conservation Service and the Forest Service in cooperation with the State of Wisconsin under the present programs of assistance.

The proposed structural works of improvement consist of four single purpose floodwater retarding structures and 1.5 miles of small mouth bass stream improvement.



The installation of all works of improvement, including structures and land treatment, will be accomplished during a five year period.

P.L. 566 costs for structural measures are estimated to be \$621,740. Other costs are estimated to be \$147,880. Other funds for the proposed structural project measures will be furnished by the Lafayette County Board and state agencies. The Wisconsin Department of Natural Resources will furnish funds for the proposed fish and wildlife improvement.

Planned structural measures will provide average annual benefits of \$58,840. The estimated average annual cost of structural works of improvement is \$45,630. This includes operation and maintenance costs which are estimated at \$3,110 annually. The benefit-cost ratio for structural measures is 1.3 to 1.0.

The Lafayette County Soil and Water Conservation District will construct, operate, and maintain the structural works of improvement.

The project will have an impact on the environment by substantially reducing erosion, sedimentation and floodwater damages. Wildlife habitat will be increased with the addition of five acres of wetland, 18 acres of lake surface, and the 1.5 miles of small mouth bass stream improvement. The project will result in a loss of about 47 acres of cropland and reduce quality on 131 acres of grassland located in dry sediment pools.

# WATERSHED RESOURCES

## ENVIRONMENTAL SETTING

### PHYSICAL DATA

First Capitol Watershed is in northwestern Lafayette County in southwestern Wisconsin. This watershed has an irregular, but roughly oval shape. The watershed is about 15 miles long and six miles wide. Total drainage area is 52,198 acres or 81.6 square miles, of which 52,064 acres are in Lafayette County and 134 acres are in Iowa County.

The city of Darlington is located at the southeastern corner of the watershed. Darlington is about 40 miles northeast of Dubuque, Iowa; 50 miles northwest of Freeport, Illinois; and 60 miles southwest of Madison, Wisconsin. The village of Belmont is located in the southwest corner of the watershed. The unincorporated village of Calamine is near the east-central watershed boundary.

The rural population of the watershed is estimated to be 1,079. The village of Belmont has a population of about 688. The population of Darlington, which is partially within the watershed, is estimated to be 2,351.

The watershed is within the Rock River subregion of the Upper Mississippi River Region as delineated by the Water Resources Council. It is also within the Southeast Wisconsin Rivers Basin where an intensive study of water and related land resources is being conducted by the United States Department of Agriculture. The watershed is located within the Southwestern Wisconsin Regional Planning area and is included in the southern district of the Wisconsin Uniform State Districts.

The watershed is characteristic of the driftless area of the Upper Mississippi River Region. It is well drained with moderate to steep channel gradients resulting in the rapid movement of floodwaters. Flooding and associated erosion and sedimentation is a continual threat to flood plain improvements.



There are four major subwatersheds in First Capitol Watershed and numerous small unnamed drainage areas that enter the Pecatonica River. These four major subwatersheds and their drainage areas are Jones Branch, 5.72 square miles; Bonner Branch and its tributary Cottage Inn Branch, 34.43 square miles; Wood Branch, 18.38 square miles; and Vinegar Branch, 4.14 square miles.

Floodwater damage is the primary watershed problem. The rural areas have a long history of flood damage to crops, buildings, fences, livestock, machinery, roads, and bridges. The city of Darlington, located immediately adjacent to and partly within the watershed suffers extensive urban damage. The village of Belmont has some urban floodwater damage and a potential for much more if flood plain development continues.



Frequent flooding occurs in rural areas.

-Setting-

Floodwater damages during severe storm events can occur on approximately 2,510 acres of agricultural land, 100 acres of urban and built-up and 120 acres of land with other uses, such as farmsteads and roads.



Serious flood hazards occur in urban areas.

Upland sheet erosion is a serious problem in the watershed. Sedimentation in the channels and flood plains poses a threat to fish and wildlife habitat as well as to agricultural use.

Soils have been derived from blown silt, alluvium, colluvium, and bedrock or residuum, which has been weathered and/or biologically altered. There are six general soil associations in the watershed. Fifty-four percent of the watershed is covered with Dubuque and Sogn silt loams. The Sogn is dark colored and shallow. The Dubuque is light colored and moderately deep. These soils are on the limestone and dolomite ridgeland.



Thirty-seven percent of the watershed is a Tama-Ashdale association of dark colored deep silt loams on the carbonate uplands. Eight percent of First Capitol Watershed has a cover of Fayette-Palsgrove. This association of light colored silt loam is found on the uplands. The remaining one percent consists of soils of the stream bottoms and terraces such as Arenzville, Boaz, and Huntsville silty alluvial soils; Sogn and Calamine silt loams derived from weathering of the Maquoketa Shale in the Belmont Mound area; and the Tama-Muscatine-Sable-Sogn association of silt loams near the village of Leslie on the western edge of the watershed. The major capability groupings in the watershed are classes IIe, IIs, IIw, IIIe, IVe and VIIs.

Ordovician and Silurian rocks crop out in the watershed but are somewhat obscured by Pleistocene or Recent deposits of soils, alluvium, loess, and colluvium. The Ordovician rocks are mainly thick to thin bedded fossiliferous limestones and dolomites with some chert in the lowest or Oneota formation. Above the Oneota is a white to yellow-brown sandstone, the St. Peter, which is a massive quartz sandstone that lacks fossils. The St. Peter is overlain by interbedded limestones, dolomites, and shales sparingly to abundantly fossiliferous--the Platteville, Decorah, Galena, and Maquoketa formations. The Edgewood formation of Silurian age, a cherty dolomite with shale partings, caps the Belmont mound.

The Paleozoic formations have a regional dip of ten to 20 feet per mile south-southwest. Superimposed on this dip are shallow folds mainly aligned in a general east-west direction.

The regional land form is in late youth or early maturity with rolling to almost flat ridgeland remnants. Slopes between the ridges and valley bottoms are usually steep and wooded with frequent outcrops of limestone, dolomite, or sandstone. The valleys have a V-shape or they are flared. Flood plains vary from 50 feet wide to more than 1,000 feet in width.

Maximum relief in the watershed is about 600 feet. The highest point is the top of Belmont Mound, 1,400 feet above mean sea level. The low point is at slightly less than 800 feet mean sea level on the Pecatonica River in the extreme southeastern corner of the watershed.

First Capitol Watershed has a humid continental climate with wide extremes of temperature. The coldest month is January with an average temperature of 20 degrees Fahrenheit (F). July, the warmest month, has an average temperature of 72 degrees F.

The average annual precipitation is 33 inches. This occurs mainly as rain during the growing season. The average length of the growing season is 140 days, with the first fall-killing frost in late September and last killing frost in mid-May. Winter prevailing winds are westerly while summer prevailing winds are southerly.

Precipitation in excess of two and one-half inches in a 24-hour period occurs annually. Run-off from storm events of this magnitude, or less, causes flooding in the watershed. Twenty-four hour rainfall in excess of four and one-fourth inches will occur on an average of once every ten years. Rainfall from storms having a frequency of once in ten to 100 years (4.25 to 6.15 inches) causes extensive flood damages.

The watershed is within the Upper Mississippi Valley zinc-lead mining district of southwestern Wisconsin. No active mines are known to exist within the watershed. However, there are some abandoned shaft and pit mines. Several rock quarry operations are present. The quarries are mainly in the Galena formation. The rock is used locally for road building and concrete aggregate.

Water supplies are obtained from shallow dug wells in alluvium, springs, and shallow to deep wells in Ordovician sandstones, dolomites, or limestones. The water ranges from hard to very hard. The average calcium-magnesium content expressed as equivalent calcium carbonate is 335 parts per million.

Land use in the total watershed and flood plain areas are shown in the table on page 9.

Small private forest lands are scattered throughout the watershed accounting for approximately 11 percent of the total land area. The 5,742 acres of forest land is located primarily in upland areas. There are only about 70 acres of forest remaining in the flood plain. Dominant forest types are mixed hardwood and oak hickory. Soil cover complexes are generally adequate to perform their hydrologic function.

<u>Land Use</u>	<u>Total Watershed</u>		<u>Flood Plain Areas</u> <u>1/</u>	
	<u>Acres</u>	<u>Percent</u>	<u>Acres</u>	<u>Percent</u>
Cropland	26,099	50	760	28
Grassland	17,747	34 <u>2/</u>	1,680	61
Forest Land	5,742	11 <u>3/</u>	70	3
Urban and Built-up	450	1 <u>4/</u>	100	4
Other	2,160	4 <u>5/</u>	120	4
Total	52,198	100	2,730	100

1/ Area inundated by a 100-year flood, not including the Pecatonica River flood plain.

2/ Includes 40 acres type 2, and 35 acres types 3, 4, 5 and 6 wetlands.

3/ Includes five acres type 7 wetlands.

4/ Includes five acres type 2 wetlands.

5/ Includes 25 acres types 2, 3, and 4 wetlands.

The hydrologic condition of 84 percent of the forest land has a high improvement potential and 16 percent has a medium improvement potential. Hydrologic condition is defined as the relative ability of specific combinations of soil and vegetative cover to absorb precipitation and retard run-off. It expresses the interrelationship existing between the soil and forest cover, and their effect on the movement of precipitation on, into and through the soil.

About 760 acres of cropland are located in flood prone areas. Despite flood hazards, potentially high yields are an incentive to crop much of the flood plain in continuous corn. A common rotation in the flood plain is six years corn, one year oats, and two years hay.

Nearly two-thirds of the flood plain area is grassland used for grazing. Most of the 1,680 acres are heavily used for this purpose.

Urban and built-up areas in the flood plain include areas in the village of Belmont and on the western fringe of Darlington.



There are approximately 80 acres subject to flooding in the village of Belmont. About 90 acres in the city of Darlington are subject to Pecatonica River flooding. Twenty acres are located within the First Capitol Watershed and 70 acres are located outside. Roads, farmsteads, and other areas occupy about 120 acres in the flood plain.

First Capitol Watershed has a dendritic drainage pattern with permanent streams fed by numerous springs and seeps. Except for a few oxbow lakes, there are no natural lakes within the watershed. Nearly all of the 173 miles of channel are unmodified. Approximately two miles of channel have been modified in the village of Belmont and to accommodate railroad and highway route locations. About 56 stream miles have perennial flow. Since nearly all of the perennial streams originate from springs with year around flow, there are practically no intermittent streams in the watershed. Ephemeral streams which accommodate flood run-off account for 117 miles of channel. The Pecatonica River, which flows along the northern and eastern boundary of the watershed, accounts for an additional 26.5 miles of perennial stream. There are numerous farm ponds and one man-made lake. Joy Lake is a private recreational development with a 555 acre-foot recreation pool and a surface area of 55 acres. It is located on Cottage Inn Branch downstream of Highway 151.

Surface water quality by subwatershed is shown in the following table. 1/

<u>Subwatershed Name</u>	<u>Total Alkalinity (mg/1.)</u>	<u>Specific Conductance (Umhos/cm.)</u>	<u>PH</u>
Jones Branch	320	490	8.5
Bonner Branch	288	726	8.3
Wood Branch	276	590	8.4
Vinegar Branch	275	719	7.7

1/ Data Source: Wisconsin Department of Natural Resources, 1967, Surface Water Resources of Lafayette County, 82 pages.



The Soil Conservation Service contracted with the University of Wisconsin, Stevens Point, to sample and make an analysis of Water Quality in the First Capitol Watershed. Samples were collected on March 4, 1974 during spring runoff and probably represent the worst water quality condition that could be expected on an annual basis. Test results for various water quality parameters are displayed in the following table.

Item	Unit	Site <sup>1/</sup>								
		1	2	3	4	5	6	7	8	9
Temperature	°C	3.0	2.0	1.0	2.0	2.0	2.0	1.0	2.0	2.0
pH	-	7.43	7.44	7.37	7.40	7.37	7.38	7.44	7.56	7.64
Conductivity	uMHOS	203	207	154.7	210	205	158	203	256	230
Alkalinity	mg/l	85	83	60	74.4	64.7	66	77.8	103	96
Total hardness	mg/l	90	106	92	102	90	102	104	130	120
Ca ++hardness	mg/l	54	60	56	64	60	44	68	48	64
Dissolved Oxygen	mg/l	11.9	11.6	11.8	11.5	11.1	11.6	11.1	11.6	11.8
C.O.D.	mg/l	158	259	284	186	157	313	174	170	240
Chloride	mg/l	13.3	18.8	20.8	25.8	29.5	27.6	14.6	17.7	17.7
Ortho P	mg/l	.48	.52	.37	.32	.41	.23	.33	.55	.64
Total P	mg/l	1.60	4.80	6.00	8.22	2.44	8.00	5.00	4.00	4.88
NH <sub>4</sub> Nitrogen	mg/l	1.93	1.65	1.65	1.33	1.71	1.86	1.65	1.54	1.05
NO <sub>3</sub> + NO <sub>2</sub> Nitrogen	mg/l	.60	1.79	2.10	2.35	2.66	2.14	1.89	2.52	1.68
Kjeldahl Nitrogen	mg/l	5.32	4.38	5.29	3.61	4.87	4.83	6.16	4.83	3.64
B.O.D.	mg/l	24.5	70	60	62	40	64	57	64	34
Fecal Coliforms	No./100 ml	1070	4000	6800	1000	3160	4800	2000	6900	7200
Dissolved solids	mg/l	162	114	116	160	142	126	92	84	168
Suspended solids	mg/l	138	1930	3224	2764	478	5126	1908	1576	2200
Total solids	mg/l	300	2044	3340	2924	620	5252	2000	1660	2368

<sup>1/</sup> Site locations can be found on the project map. Sites 1 and 2 are on Cottage Inn Branch at the township roads immediately above and below FRS No. 2 respectively. Site 3 is on Bonner Branch at County Trunk Highway G above the Belmont sewage treatment plant. Site 4 is on Bonner Branch at County Trunk Highway G below FRS No. 3. Sites 5 and 6 are on Wood Branch at the first township road above FRS No. 4 and at County Trunk Highway O respectively. Sites 7 and 8 are on Vinegar Branch at the first township road above FRS No. 8 and at County Trunk Highway F respectively. Site 9 is on Jones Branch at the township road crossing.

All samples were very high in biochemical oxygen demand, suspended solids, fecal coliform bacteria, soluble and organic nitrogen and phosphorous. These components tend to increase as the drainage area increases. Sample 1 and 5, being in the best condition, are located nearer the headwater of the stream or shortly after an existing impoundment as in sample 1. Samples were fairly low in hardness and alkalinity. pH was nearly neutral, but slightly basic.

Samples indicate that surface water quality in First Capitol Watershed is at least seasonally unsafe for water contact sports due to the high fecal coliform counts.



Nearly six tons per acre per year of cropland sheet and gully erosion is presently occurring in the watershed. Industrial pollution from the village of Belmont has caused some impairment of the chemical water quality in Bonner Branch in the past.

The watershed consists of four major subwatersheds and numerous small unnamed drainage areas that enter the Pecatonica River independent of one another. Bonner Branch, which is the largest subwatershed, is the only one that flows through an urban area before it enters the Pecatonica River.

Bonner Branch rises in Lafayette County in Section 4, T. 3N, R.1E. The stream is intermittent for about a mile and one-half. It flows in a generally easterly direction and enters Belmont about 2.5 miles downstream. After flowing about one mile within the village limits of Belmont, it continues on for about ten miles before it joins the Pecatonica River near Calamine.

Jones Branch, the northwestern most subwatershed, rises in Lafayette County at Belmont Mound in the northeast corner of Section 3, T. 3N., R. 1E. The intermittent portion of the stream flows in a northerly direction for about one and three-fourths miles. The spring fed stream becomes perennial in Section 27 T. 4N., R.1E., and flows in a northeasterly direction through agricultural land for about 2.7 miles. It joins the Pecatonica River approximately 22 river miles above Darlington.

Wood Branch begins in the northeast quarter of Section 30, T. 3N., R. 2E., and flows about nine miles in an easterly direction before emptying into the Pecatonica River approximately four miles above Darlington. The stream is intermittent for nearly three miles before it becomes perennial. The Wood Branch subwatershed is agricultural.

Vinegar Branch, the southeastern most subwatershed, is also the smallest. It begins in the middle of Section 1, T. 2N., R. 2E., and flows in a generally easterly direction before it empties into the Pecatonica River just inside the city limits of Darlington. This warm water drainage stream has about 1.5 miles of intermittent and 3.8 miles of perennial flow. Land use in this subwatershed is mostly agricultural with some urbanization near the mouth.

The few small wetland areas in the watershed are located in the flood plains of the Pecatonica River and its major tributaries. Wetlands and wetland types are defined in Wetlands of the United States Department of the Interior, Fish and Wildlife Service Circular C-39. There are an estimated 110 acres of wetlands in the watershed. These include 50 acres of type 2, 30 acres of type 3, and 30 acres of types 4, 5, 6 and 7.

## ECONOMIC DATA

Land ownership is generally private. There are about 200 acres of state owned land managed by the Wisconsin Department of Natural Resources as a state park area. First Capitol State Park is a historic site which includes the original capitol and legislative buildings for the state of Wisconsin. Belmont Mound is a scenic attraction located less than one mile away. Although physically separated, the two areas are managed as a single park unit. Other public lands are limited to buildings, roads, and community parks.

First Capitol Watershed is heavily farmed with the sale of livestock, poultry and their products accounting for 94 percent of the cash farm income. According to the 1970 U.S. Census of Agriculture, farms in Lafayette County had an average net cash income of \$11,300, compared to the state average of \$7,400. This county average is also typical of the watershed. Agriculture is the largest single source of employment in Lafayette County and utilizes approximately 44 percent of the labor force as compared with 11 percent of the labor force in the state of Wisconsin.

A fair market exists for timber products from wood lots. This provides some income and employment through timber harvesting and timber stand improvement measures. Other intangible woodland values include public needs for recreation, wildlife and open space.

Sixty-three percent of the farmers in the watershed are district cooperators and own 31,383 acres of land. There are 172 farm units in First Capitol Watershed. The majority of the farm units are classed as family type farms. It is estimated that only three farms employ more than one and one-half man years of additional



hired labor per year. The average size farm is 288 acres although one beef producer has a unit of about 4,000 acres. There is a trend toward smaller farm units being incorporated with the larger units because of rapid technical advances and mechanization in farming.

Principal crops grown are corn, oats and hay with minor amounts of barley, soybeans and canning peas and corn. Almost all of the feed and grain crops grown are utilized on farms within the watershed.

A common rotation in the flood plain is six years corn, one year oats and two years hay. Much flood plain land is in continuous corn. Upland rotations average two years corn, one year oats and three years hay.

Current flood-free yields per acre are: corn - 110 bushels; oats - 70 bushels, and hay - four ton. Upland yields are: corn - 95 bushels, oats - 60 bushels, and hay - three and one-half tons.

The value of agricultural land varies significantly. Average values are estimated at \$400 per acre in the flood plain and \$450 in upland areas. Land for new urban development has an average value of \$950 per acre.

First Capitol Watershed has an excellent network of federal, state and county trunk roads. U.S. Highway 151 crosses the watershed northeast to southwest through Belmont, located in the western portion of the watershed. State Highway 81 follows the southern boundary of the watershed west from Darlington. County Trunk Highway "G" crosses the center of the watershed in an east-west direction from Belmont to Calamine. County Trunk Highway "O" is a north-south artery which crosses the center of the watershed linking U.S. Highway 151 to Highway 81.

A spur line of the Chicago, Milwaukee, St. Paul and Pacific Railroad crosses the central part of the watershed in an east-west direction along Bonner Branch from Belmont to Calamine. On December 21, 1972, the railroad filed with the Interstate Commerce Commission at Washington, D.C., an application for a certificate of public convenience and necessity permitting abandonment of this spur line. The application, which was assigned finance docket No. 26961, provided a June 12, 1972, deadline

for protests. The request for abandonment is presently in Washington, D.C., awaiting approval from the Interstate Commerce Commission.

Additional town and county roads, of which many are hard-surfaced, serve as good all year farm to market roads.

U.S. Census Bureau data shows that the three rural townships of Kendall, Willow Springs and Belmont in Lafayette County have decreased from a population of 2,015 in 1950 to 1,719 in 1970. This reduction of about 15 percent in population is a result of farm consolidation and a shortage of jobs for off-farm employment.

Lafayette County is eligible for assistance under Title I of the Public Works and Development Act.

### **FISH AND WILDLIFE RESOURCES**

Upland game can be found throughout the watershed. The diversified topography and vegetative cover is suitable environment for many wild animals. Wildlife residing within the watershed include whitetail deer, gray and fox squirrels, cottontail rabbits, red and gray fox, ruffed grouse, bobwhite quail, Hungarian partridge, raccoon, badger, mink, muskrat, skunk, opossum, and snakes. Over 100 species of birds visit the watershed either as residents or migrants.

Sport fishing opportunities are present in all perennial streams. Bonner Branch and Wood Branch carry populations of trout and small mouth bass. Jones Branch is classified as trout water and is stocked annually with brown trout.

### **RECREATIONAL RESOURCES**

Existing recreational resources include a 200 acre state park development and a private lake development. The state park is located in an area of historic and scenic interest two miles northwest of Belmont. Facilities are limited to picnicking and hiking. There is no opportunity for water based recreation in this park.



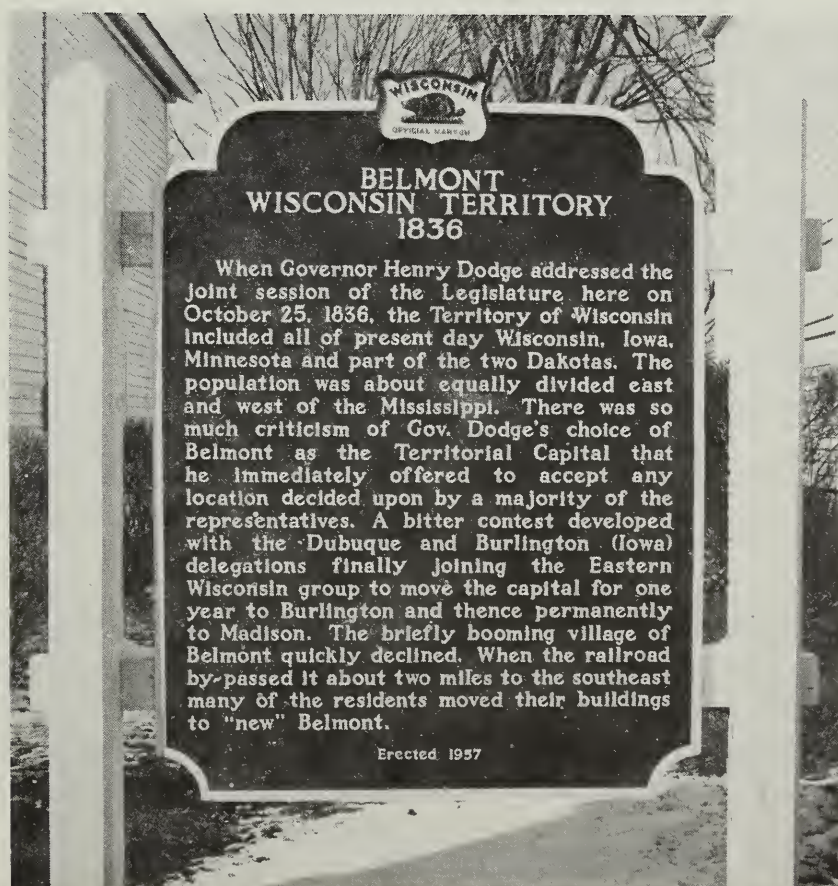
Joy Lake, a private lake development, consists of a 55 acre lake created by a dam controlling a 2.27 square mile drainage area on Cottage Inn Branch. The recreation pool has a maximum depth of 27 feet and an average depth of ten feet. The area around the lake may be sold for private building sites. The development is located three miles northeast of Belmont.

The First Capitol Watershed has a high recreation potential in terms of topography and natural beauty. The limiting factor is a lack of water based recreation opportunity.

Use of existing facilities is limited by the lack of water based recreation opportunities. Stream fishing opportunities are good with both trout and small mouth bass streams located in the watershed. Water quality in the streams is generally good.

### ARCHEOLOGICAL AND HISTORICAL VALUES AND UNIQUE SCENIC AREAS

Inquiries did not disclose any known areas of archeological value in the watershed. The site of the first capitol and legislative



-Setting-

buildings for Wisconsin is located in the watershed. This historic site, which is listed in the National Register of Historic Places, has been restored and is managed as a small state park.

The watershed is rich in scenic values. The rolling hills and well defined streams have much natural beauty. The most outstanding topographic feature, Belmont Mound, is managed by the Wisconsin Department of Natural Resources as a state park.

A natural area inventory of Lafayette County sponsored by the DNR, Bureau of Planning, and the Scientific Areas Preservation Council was completed early in 1973. Four areas delineated occurred within the First Capital Watershed, and two of these were determined to be of state natural area significance.

### **SOIL, WATER, AND PLANT MANAGEMENT STATUS**

Soils in this watershed are predominantly of capability classes IIe, IIs, IIw, IIIe, IVe and VIIs.

The topography is characterized by relatively few uplands and steep, narrow V-shaped or flared valleys.

Dairy and livestock farming predominates with cropping patterns of corn, oats and hay. Present land use is nearly within its capability with no appreciable change in land use foreseen.

Watershed farmers have an active land treatment program. To date, \$401,700 have been spent on installation of land treatment measures, (Table 1A). One hundred and seven watershed landowners are presently cooperators with the Lafayette County Soil and Water Conservation District. Ninety-four cooperators have conservation plans on 26,471 acres, or 49 percent of the watershed.

Based on land treatment goals contained in existing resource conservation plans, the percent of planned land treatment measures installed to date are as follows: contour stripcropping - 65 percent; grassed waterways and outlets - 25 percent; diversions - 25 percent; erosion control structures - ten percent; and critical area planting - 45 percent.

Conservation cropping systems are being followed on 49 percent of the cropland area.

Adequate forest fire protection is provided by the Wisconsin Department of Natural Resources in cooperation with the U.S. Forest Service under the Clarke-McNary Cooperative Forest Fire Control Program. Other current federal-state cooperative forestry programs include: Cooperative Forest Management, Cooperative Forestation, and Cooperative Forest Pest Management.

Under existing cooperative forestry programs during the past ten years, all 5,742 acres of forest land were adequately protected against fire. During this period 33 acres of tree planting, 47 acres of stand improvement, and 358 acres of grazing control were accomplished. Ten management plans for 145 acres were developed.

Some problem areas remain on forest land where grazing has deteriorated watershed and timber values. About 34 percent of the forest land is adequately protected.



# WATER AND RELATED LAND RESOURCE PROBLEMS

## LAND TREATMENT

Important land treatment problems encountered in First Capitol Watershed include sheet, gully and streambank erosion; surface run-off; and improper woodland and pasture management. Land treatment needs include the orderly removal of surface run-off, the control of all forms of erosion to reduce undesirable sediment accumulation, the preservation of soil fertility, and the retention of water to maintain a desirable soil-water relationship.



Poor land treatments results in serious erosion and sediment damage.

The principal flood problem is floodwater and sediment damage to agricultural and nonagricultural properties. Crops and pasture, livestock, equipment, buildings, highways, roads, bridges, public utilities, urban and other properties are damaged or destroyed by flooding.

## FLOODWATER DAMAGE

Floodwater damage within First Capitol Watershed is the primary problem. Stream flow records for the Pecatonica River at Darlington show that many floods of major proportions have occurred over the period of record. Since 1948, roads have been barricaded and traffic rerouted over 20 times due to floods. In some years, flood plain land has been inundated several times. Past floods have destroyed crops and pasture; washed out roads, bridges, and fences; damaged equipment; drowned livestock; and deposited debris on crop and pasture land. Fish and wildlife habitat has also been damaged by floodwater.



Flood damage to agricultural land.

The flood plain area subject to inundation is approximately 2,730 acres involving approximately 54 farm units. This does not include the Pecatonica River flood plain. Frequent and severe flooding reduces crop and pasture yields and makes efficient management difficult. Interviews have established that flood plain land has changed from cropland to pasture because of frequent



flooding. It is estimated that small frequent floods up to a ten year frequency account for 78 percent of the total average annual damages.

The city of Darlington, which is partially within the watershed and immediately downstream, is subject to flooding from the project area run-off. First Capitol Watershed is about 30 percent of the total drainage area above Darlington. The approximate value of private and public property subject to floodwater damage is \$4,870,000. The U.S. Army Corps of Engineers stated in a survey report dated February 14, 1962, that the average annual flood damage to Darlington is about \$77,200. The report also indicated that the average annual property damage to rural property along the Pecatonica River from Calamine to about four miles south of Darlington was estimated at \$66,300.

One of the most severe floods of record occurred in July 1950. Property damaged by this flood was estimated at \$1,015,800. A flood of the magnitude of the July 1950 event is expected to occur, on the average, of once every 60 years.

Another severe flood occurred in June 1969 which was described as follows:

The Republican Journal, Darlington, July 3, 1969

"The four hour rain Sunday evening (June 29) dumped 6.35 inches of rain on Darlington. This is the greatest single rain ever received here. The greatest daily rainfall previously recorded was 4.92 inches in August of 1942. Much greater amounts fell to the north of the city, but no official record is available on the rain there.

An estimated several million dollars of damage has been done in Lafayette County in the past five days.

There was an almost continuous heavy rainfall for a four hour period, resulting in severe flood conditions and extensive damage to farmland and crops, business places in Darlington, and innumerable basements far out of the flood area.



Roads and highways were blocked as bridges were knocked out and landslides covered highways. It is estimated that some 14 bridges, including state, county, and township bridges were knocked out in Lafayette County.

Army Flood Engineers reported that at its crest the Pecatonica reached 19.1 feet, about two feet lower than the record flood of July 16, 1950. The 19.1 foot stage was listed as 11 feet above flood stage. The only thing that saved the city from considerably greater damage was that only about an inch of rain fell in the Mineral Point area.

In Darlington, as soon as the flood alarm was sounded, businessmen and scores of other residents poured into the business district and started to move cars, merchandise and records to higher shelves or out of business places entirely where this was possible.

The water rose so rapidly, however, that it was impossible to get done all that needed to be done. Both Darlington Motor Sales and Ostby Motors lost three units covered with water and McNett Chevrolet-Buick-Olds one unit.

At Darlington Milling Company it was possible only to get a few of their many motors out and impossible to move the thousands of pounds of feed and concentrates at their several locations, all in the flood zone.

Ancient wells and springs that haven't flowed for decades suddenly came to life and gushed forth.

Every business place in the two block area of the Pecatonica in Darlington suffered loss. The Towne Theatre interior was covered and all the seats beneath water. The Kroger Store had about two feet in the store and lost a considerable amount of merchandise as well as motors on refrigeration units. All frozen food and refrigerated food was lost."

The key flood studied occurred June 29-30, 1969. A flood of this size can be expected to occur on the average of once every 25 years. Flooding caused damage to 14 homes and 65 commercial establishments. About 1,570 acres of crop and pasture land were

-Problems-

inundated. In addition, fairgrounds, public utilities, Belmont village park, streets, roads, bridges, and railroads were damaged. Damage to both agricultural and nonagricultural properties for a future storm of this magnitude would be approximately \$1,000,000.

Total average annual damages from floodwaters within the watershed are estimated at \$35,780. Agricultural damages are \$21,920 and nonagricultural damages are \$9,720 annually. Indirect damages are estimated at \$4,140.

### **SEDIMENT DAMAGE**

Sediment damage has been considered in conjunction with flood damage. Sheet erosion from cropland is the principal contributor of sediment in the watershed. Gully, streambank, and roadside erosion are also sediment sources. Excess runoff transports sediments from the uplands to downstream areas of deposition. Sediment deposited by floodwater causes crop damage and decreases water infiltration. It is estimated that approximately 14.4 acre-feet of sediment is delivered annually to the Pecatonica River.

In urban areas sediment is deposited inside homes, and commercial and public buildings. This causes extensive damage to stored goods, carpets, electric appliances and motors, and furniture. A large amount of time and money is spent removing sediment and cleaning floors, drapes, and building furnishings. Sediment is deposited on lawns and driveways, thus discouraging yard beautification. Sediment deposited on parks, roads, highways, and other public properties must be removed by the state, county, or communities affected.

Sediment laden floodwater damages automobiles and farm machinery. Normal farm operations are disrupted by the dismantling and repair of machinery damaged by sediment. Fish and wildlife habitat have been damaged and destroyed by floodwater and sediment. Sediment damages caused by the June 1969 storm were evaluated in conjunction with floodwater damages. Although evaluated as inseparable, a reasonable estimate of damages attributable to sediment would be about 26 percent of the total.



Sediment damage to cropland.

### EROSION DAMAGE

The topography of the watershed varies from gentle slopes to very steep hillsides. Gully erosion has been significant in the past, but is no longer a serious problem. Roadside erosion in the watershed ranks 25th in severity among the 72 counties of the state. The watershed road cuts and ditches are usually well vegetated with an occasional break in the cover, and some small shows of washed soils, sand, silt, and gravel in the ditches. Ninety percent of roadside erosion is on town roads. This type of erosion is unsightly and increases highway maintenance costs, particularly on town roads. Most of the resulting sediment is trapped in road ditches and other structures before it reaches the major drainage system.





Roadside erosion destroys the aesthetics and is a source of sediment.

Channel erosion in upstream areas is variable, but is generally less than 0.075 feet per year. Downstream the rate of lateral bank cut increases, but again has a rather wide range, varying from about 0.025 to 0.12 foot per year. Several steep main channel banks may have a lateral bank cut as high as 0.15 of a foot per year. Sediment resulting from channel erosion was estimated to be about ten percent of the total sediment load in the streams.

No separate monetary value was determined for the gully, roadside, or streambank erosion.

Upland sheet erosion in the watershed is by far the most serious form of erosion in terms of tons of soil loss. Some cropland is currently contributing up to 16 tons per acre per year. The watershed average for cropland is about 5.8 tons per acre per

year. Sheet erosion losses on grassland is estimated at one-half ton per acre per year or less. Average losses on forest land is 0.16 tons per acre per year. On a portion of the forest land the absence of management attention and domestic livestock grazing have caused a greater susceptibility to surface run-off and erosion.

Upland sheet erosion not only reduces fertility and increases management costs, but it shortens the productive life of agricultural lands. Deposition of sediment eroded from the uplands causes additional damages to fish and wildlife habitat and agricultural lands. Average annual monetary erosion damages were not calculated as a separate item.

## RECREATION

Water based recreational opportunity within the watershed is limited to a 55 acre private lake, a few small oxbow lakes, and the stream system. The streams provide sport fishing opportunities, but flooding and lack of proper land management seriously jeopardize existing fisheries. Chemical water quality is generally good. However, sediment is one factor presently reducing the quality of fish habitat.

Access to existing water resources is controlled by private ownership. There is not only a need for additional water based recreation within the immediate area, but there is also a need for public access to the existing resources.

Water based recreational opportunity within the area includes Yellowstone Lake, installed by the Department of Natural Resources and located about ten miles northeast of Darlington. Governor Dodge State Park, located about 26 miles north of Darlington, has recreational facilities. However, present and future needs far exceed present or planned recreational facilities.

There are an estimated 460,000 people residing within a 50 mile radius of the watershed.

Local interest in developing additional recreational resources is divided. The need and desire for more recreation areas is generally supported, but certain interest groups are opposed to specific types of recreational developments. Small community type developments along with enhancement of fishing opportunities are locally supported.



## FISH AND WILDLIFE

The watershed fishery is an important resource. Good populations of game fish currently inhabit the streams but flooding and sedimentation are a constant threat to the habitat. Populations of most upland game species are low because of limited nesting and winter cover. The destruction of farm and roadside hedgerows has reduced prime habitat for a number of species. Waterfowl production is negligible due to a lack of suitable water areas.

There is a need to protect the existing fishery resource from flooding, erosion and sedimentation damage. Hunting and fishing pressure indicates the need for increased fish and wildlife resources. This can be accomplished in part by increasing and improving existing habitat.

There are no known rare or endangered species resident in the First Capitol Watershed. The Arctic Peregrine falcon may be an infrequent migrant.

## OTHER PROBLEMS RELATING TO WATER MANAGEMENT

Outlets for drainage are not expected to become an important consideration as the existing channels are adequate in depth and capacity to remove run-off from normal rainfall.

There is little or no irrigation within the watershed. Because of local cropping systems and local climatic and economic conditions, the water requirement for this purpose is not expected to become important.

Water supplies for livestock and general farm use are generally adequate. Ground water supplies are adequate for anticipated municipal and industrial water supply needs in the watershed.

## ECONOMIC AND SOCIAL

All but three of the 172 farm units in the watershed are classed as family type farms. Many of the farmers are dependent on off-farm employment to supplement their farm income. Shortage of such jobs has contributed to an out migration to seek employment elsewhere. Three townships in the watershed experienced a 15 percent decrease in population between 1950 and 1970. Nearly all of the area subject to flooding is on family farms.

There is a need for rural community development in and around the watershed. Additional employment opportunity along with increased operating efficiency is needed to provide incentive for the younger adults to remain on the family farm. Increased employment opportunity would also be an asset to the city of Darlington.

## PROJECTS OF OTHER AGENCIES

The Rock Island District, U.S. Army Corps of Engineers, is making a survey scope study of the Rock River Basin above Rockton, Illinois, to determine the advisability of improvements for flood control and allied water resources and related land resources in the basin. The resolution for the study by the Committee on Public Works of the House of Representatives was adopted on October 5, 1966.

A survey report for the Pecatonica River Basin was completed by the Corps of Engineers in 1962. The report recommended a local flood control project at Darlington, Wisconsin. The project was authorized by Congress in the Flood Control Act of 1962, but has not been funded for post-authorization design and construction. Investigations for flood control storage on the main streams and tributaries in the Pecatonica Basin were conducted at the time of the 1962 survey report. Economic feasibility for such a project was lacking at that time.

Structural and nonstructural measures for reduction of flood damages are being examined in the current study of the Pecatonica Basin. Multiple purpose reservoirs on the Pecatonica River in the vicinity of Calamine and Mineral Point, Wisconsin, are being investigated as a means to reduce flood damages at Darlington and in rural and urban areas in the Pecatonica River flood plain, and also to provide for recreational and water quality control needs.

Belmont Mound State Park and First Capitol State Park are located in the watershed. Except for picnic grounds, no recreational facilities exist at either of these parks.



## PROJECT FORMULATION

An application for planning assistance was received in October 1965. The State of Wisconsin Board of Soil and Water Conservation Districts (formerly the Soil Conservation Board) conducted a feasibility study in November 1965 and placed the application in a priority pool. The State of Wisconsin Board of Soil and Water Conservation Districts established priority for the First Capitol Watershed in December 1966. The River Basin -Watershed Planning Staff of the Soil Conservation Service in Wisconsin conducted a preliminary field investigation in April 1967 and submitted a favorable preliminary investigation report in August 1967.

Some 19 organizational and informational meetings were held with the sponsors, watershed residents, and other interested agencies up to the time that the preliminary investigation report was presented. The project formulation outlined in the preliminary investigation report represented the collective inputs and approval of all concerned agencies and individuals.

Planning approval was requested in January 1969 and received from Washington in March 1969. Throughout the planning process an additional 21 meetings were held. The primary purposes of these meetings were to exchange information and keep up-to-date on local developments. A special attempt was made to keep landowners, watershed residents, special interest groups, the general public, and cooperating agencies fully informed about the planning process. As planning progressed, newspaper articles, a brochure, spot radio announcements and newsletters kept the public informed.

First Capitol Watershed is within the U.S. Army Corps of Engineers' Rock River Basin Study. Structural works of improvement recommended in this work plan are incorporated in alternative flood control plans for the basin.

The watershed is also within the U.S. Department of Agriculture Type IV Southeast Wisconsin Rivers Basin Study area. It has been designated as one of 15 watersheds recommended for early action within the basin. The river basin study indicates a need for flood control, land treatment and recreational development.



## OBJECTIVES

The project objectives represent the wishes of the local people as originally outlined in the watershed application and updated throughout the planning process. A major land treatment goal is to get adequate treatment on 75 percent of the upland within the five year project period. This will require land treatment practices on an additional 11,150 acres. Measures are to be installed for reducing erosion, sedimentation, agricultural pollutants, and run-off volumes. Selected measures are based on need, soil capability, woodland condition, land and water use, and financial capabilities of landowners and operators.

The primary objective of the local people is the reduction of floodwater damage throughout the watershed area. The specific objectives are summarized below.

1. Establish land treatment and structural measures which will contribute directly toward watershed protection and flood prevention.
2. Reduce floodwater, erosion and sediment damage to crops and pasture, equipment and on farm facilities. A two- to ten-year level of flood protection is desired in the rural areas of the watershed.
3. Reduce floodwater inundation and sediment deposition to residential and commercial properties in Darlington. The maximum practical level of protection is desired.
4. Reduce floodwater and sediment damage to roads, highways, and appurtenant drainage structures.
5. Improve fish and wildlife resources.
6. Develop water and land based recreational facilities.
7. Improve water quality by reducing sediment and agricultural pollutants.

Project formulation, including land treatment and structural measures, was determined after considering the various alternatives that would meet the sponsors' objectives and be within the Soil Conservation Service standards and policies.

The project selected consists of land treatment measures supplemented by four floodwater retarding structures and 1.5 miles of small mouth bass stream fishery improvement.

### ENVIRONMENTAL CONSIDERATIONS

Environmental impacts of the proposed project measures were analyzed. The impact of proposed land treatment measures were found to be predominantly favorable. Protection of the soil resource, reduced erosion and sedimentation, increased soil moisture, improved wildlife habitat, and increased crop production, are all favorable effects resulting from land treatment.

Environmental impacts of the proposed structural measures were mostly favorable, but some adverse effects were determined. Particular attention was devoted toward features of the plan which would eliminate or minimize the adverse impacts.

Health and water quality associated with the dry sites was considered by specifying maintenance of a positive gradient through the sediment pool. Structural features allowing the complete draw down of the wet pool at Site No. 8 will eliminate potential water quality problems that could develop. Structures are located so that no displacement of people, businesses, or farm operations would be necessary.

Increased stream sedimentation during construction will be minimized by the use of sediment basins and immediate revegetation of denuded areas. The amount of land committed to the structures was minimized by careful site selection. The dams will be designed to blend into the landscape with a minimum amount of disruption of natural beauty.

Reduction in flood peaks, reduced erosion, downstream damage reduction, increased water area, increased wetland area, and small mouth bass stream improvement features are all favorable effects resulting from the four floodwater retarding structures and the 1.5 miles of small mouth bass stream improvement.

## ALTERNATIVES

Various combinations of structural and nonstructural measures were considered, including those suggested by interested agencies, groups and individuals. The more significant alternatives considered to solve the water and related land resource problems were:

1. Continuation of the present trends.
2. Accelerated land treatment.
3. Accelerated land treatment, flood plain zoning and flood proofing of existing buildings subject to flood damage
4. Accelerated land treatment, nine floodwater retarding structures, and one multiple purpose recreation and floodwater retarding structure.
5. Accelerated land treatment, four floodwater retarding structures, one multiple purpose structure, 1.9 miles of trout stream improvement, 1.5 miles of smallmouth bass stream improvement and recommended flood proofing and flood plain zoning in urban areas.
6. Accelerated land treatment, flood plain zoning and flood proofing in urban areas, and purchasing 1600 acres of rural flood plain.

Continuation of the present trends in the use of the watershed will result in part of the land treatment being installed

With the ongoing rate of applying land treatment measures continuing at about half of the accelerated rate, the average cropland erosion rate will be reduced from 5.8 to 4.7 tons per acre per year. Land treatment will reduce flood damages by about one percent or \$500 annually. Cost of installing land treatment at the present rate for the next five years is estimated at \$112,000. All monetary benefits from continued agricultural production and reduced erosion resulting from land treatment have not been evaluated. If the project is not installed, it is estimated that \$13,210 of net average annual benefits would be foregone.



## Project Formulation

Eliminating all structural measures from the plan and installing only ongoing and accelerated conservation land treatment would reduce the annual rate of erosion from cropland from 5.8 to 3.5 tons per acre per year, which is essentially the same as for the planned project. Floodwater and downstream sediment damages would be reduced by less than 3 percent or about \$1,230 annually. Cost of installing land treatment measures at the accelerated rate during the 5-year installation period is estimated at \$232,590. Net average annual benefits foregone would be \$13,210.

A program including accelerated land treatment, flood plain zoning and flood proofing of existing improvements was considered. Accelerated conservation land treatment would have the same effect as discussed in the last alternative.

Flood plain zoning would reduce future damages by restricting development in areas subject to flooding. Only uses subject to minimal flood damages such as day use recreational areas and environmental corridors should be allowed. This is especially effective in preventing damages in potential urban areas. Although flood plain zoning can reduce damages in rural areas, it is generally less effective because of the extensive land use involved. Except at great expense for relocation, roads and bridges in the flood plain will continue to sustain damage. Without prohibitive land use restrictions, agricultural use and associated damages will continue as a calculated risk.

A flood hazard study for the Village of Belmont prepared by the Soil Conservation Service has been completed. This study will be used to establish a flood zoning ordinance based on criteria outlined in chapter NR 116 of the Wisconsin Administrative Code. The city of Darlington has adopted a flood zoning ordinance.

Flood proofing of two homes and four businesses is recommended as the most practical means of reducing existing flood damages in Belmont. Most of the homes and many of the businesses in Darlington are not readily adaptable to floodproofing.

The cost of this alternative is estimated to be \$302,000. Net average annual benefits foregone would be approximately \$13,000.



## Project Formulation

Installation of accelerated conservation land treatment supplemented by nine floodwater retarding structures and one multiple purpose recreation and flood retarding structure would provide maximum reduction in floodwater and sediment damages in the rural areas of the watershed. They would provide 100-year flood protection in the village of Belmont and provide approximately 12 percent average annual damage reduction in the city of Darlington. Floodwater and sediment damages would be reduced by about 70 percent in the flood plain below the structures. The multiple purpose structure and facilities would provide an opportunity for water-based recreational activities. The facilities would provide about 34,800 recreation visits annually. Improvement of fish and wildlife resources would be incidental. Agricultural and associated wildlife use would be lost on 85 acres of cropland, 200 acres of grassland, and 6 acres of woodland by the construction of the ten structures, spillways, and sediment pools. Agricultural and associated wildlife use of 103 acres of cropland and 265 acres of grassland would be periodically interrupted by floodwater in the flood pools of the ten structures. The estimated cost of installing this combination of structural measures is \$2,150,000. The benefit-cost ratio is estimated to be 0.8 to 1.0.

Installation of accelerated conservation land treatment supplemented by four floodwater retarding structures, one multiple purpose structure, 1.9 miles of trout stream improvement, 1.5 miles of smallmouth bass stream improvement, and recommended flood proofing and flood plain zoning would provide 2- to 20-year flood protection. Floodwater and sediment damages would be reduced by 65 percent in the flood plain below the structures. Damages in Belmont would be reduced through flood plain zoning and flood proofing. Average annual floodwater and sediment damages to the city of Darlington and the Pecatonica River flood plain outside of the watershed would be reduced about 11 percent. The multiple purpose structure and facilities would provide an opportunity for water-based recreational activities. The State and county would purchase additional land for future expansion. This area would become a state park by combining it with the two existing state parks. The 1.9 miles of trout stream improvement and 1.5 miles of smallmouth bass stream improvement would improve the fishery resource of the watershed. Excluding the expanded park area, the multiple purpose structure and facilities and the stream improvements would provide about 35,900 recreation visits annually. Agricultural and associated wildlife use would be lost on 47 acres.

of cropland, 184 acres of grassland, and 5 acres of woodland by the construction of the five structures, spillways, and sediment pools. Agricultural and associated wildlife use of 71 acres of cropland and 178 acres of grassland would be periodically interrupted by floodwater in the flood pools of the five structures. Approximately 24 acres of grassland along the 1.5 mile smallmouth bass stream improvement and 1 acre of cropland, 21 acres of grassland, and 8 acres of woodland along the 1.9 mile trout stream improvement would be removed from agricultural land use. The estimated cost of installing this combination of structural measures is \$1,536,030. The benefit-cost ratio would be 1.1 to 1.0. This alternative was rejected on the basis of the outcome of an advisory referendum which was 487 votes for and 515 votes against the recreation development.

Installation of accelerated conservation land treatment supplemented by flood plain zoning and flood proofing in urban areas, and the purchase of 1600 acres of rural flood plain was considered. Conservation land treatment would provide the same protection to the uplands as the planned project. Flood plain zoning for urban areas would reduce future increases in urban flood damages. Flood proofing in Darlington would reduce flood damages to two homes and four businesses.

Purchasing the 1600 acres of rural flood plain would eliminate \$21,920 average annual agricultural damage. Road and bridge damage of \$9,720 annually would remain essentially the same. An additional \$21,940 of average annual urban and rural flood reduction benefits along the Pecatonica River would be foregone. Loss of 1600 acres of agricultural land from production would reduce net farm income by \$37,360 per year. The tax base would be reduced. Reduced farm income would reduce the demand for goods and services creating an adverse economic impact on the entire community. Increases in wildlife and recreational lands would have a favorable impact on the environment.

Purchasing the 1600 acres of rural flood plain would involve 33 landowners. It is estimated that 10 landowners would suffer minor severance damages in the form of inconvenience and disrupted operations. The remaining 23 owners would suffer major severance damages in terms of access and general operating efficiency. As many as five sets of farm buildings would have to be relocated. Several farm units would become economically marginal and a few may become uneconomic.

## Project Formulation

It is estimated that the average cost of acquiring the flood plain would be a minimum of \$800 per acre. This includes severance and relocation costs. The total direct cost of acquiring the 1600 acres of flood plain would be \$1,280,000. Total project cost including land treatment would be \$1,512,590. Amortized at 5 1/2 percent interest the average annual implementation cost becomes \$83,586. Average annual flood damage reduction benefits would be \$23,150. This includes \$21,920 of agricultural damage eliminated by purchasing the 1600 acres of flood plain and \$1,230 from land treatment. The benefit-cost ratio would be 0.3 to 1.0. This analysis does not include indirect costs such as reduced business activity and loss of tax base, nor does it include annual maintenance cost for fencing, weed control, etc.

The works of improvement included in this plan were selected to meet the sponsors' objectives with the least amount of adverse impact to the environment. Land treatment measures, along with four floodwater retarding structures, 1.5 miles of small mouth bass stream improvement and recommended floodproofing and flood plain zoning in urban areas were selected.

This selected plan will meet the sponsors' objectives for land treatment; damage reduction from erosion, sedimentation and flooding; fish and wildlife improvement; and incidental damage reduction in the city of Darlington. It will not meet the sponsors' original desire for developing water and land based recreational facilities. This objective was deleted when local opposition developed during planning.



# WORKS OF IMPROVEMENT TO BE INSTALLED

## LAND TREATMENT MEASURES

The application of land treatment measures and practices outlined in this plan will meet the watershed program objectives. Resource conservation plans developed for the operating units of the watershed and implemented on an individual farm basis will provide for proper land use, adequate treatment and proper management of the farm land.

A combination of land treatment measures will be applied by individual farm operators or owners for the purpose of soil and water conservation, particularly in the upland areas. In order to adequately protect the watershed, the present Lafayette County Soil and Water Conservation District program will continue to stress the application and maintenance of conservation practices. This includes the use of land within its capabilities and treatment in accordance with its needs for sustained agricultural production.

Soil surveys in the First Capitol Watershed have been completed. Soil survey information for Lafayette County is available in a published Soil Survey Report issued in August 1966.

An accelerated program of land treatment measures is planned during the five year project installation period. Seventy-five percent of the upland area will be adequately treated within this period. The acceleration will follow criteria outlined in the technical guide for the area and strengthen existing programs.

Approximately 13,000 acres of cropland, 10,000 acres of grassland, 1,300 acres of other land and 2,000 acres of forest land are now adequately protected. Within the five year project period, an additional 6,500 acres of cropland, 4,000 acres of grassland, 650 acres of other land and 460 acres of forest land will be treated.

Amounts of land treatment measures to be applied during the five year project installation period were determined by the District Supervisors and the Directors of the Watershed Association based on recommendations of the Soil Conservation Service, U.S. Forest Service, and the Wisconsin Department of Natural Resources.



## -Improvements to be Installed-

Land treatment measures to be applied on cropland, pasture, and other land (building sites, roads, etc.) include: conservation cropping system, contour farming, critical area planting, diversion, grade stabilization structure, grassed waterway and outlet, minimum tillage, pasture and hayland planting, streambank protection, strip cropping, terraces, tree planting, and wildlife habitat improvement and management.

A typical combination of practices on sloping cropland fields will be contour strip cropping, conservation cropping systems, diversions, and grassed waterways. On gentle slopes alternatives to contour strip cropping are the use of terraces or diversions with contour farming.

Pasture and hayland management is an essential practice. It will be the conservation practice applied to about 30 percent of the pasture. Diversions and erosion control practices are needed where gullies are to be controlled.

The land treatment measures are based on present and projected land uses. If the future land use differs appreciably from that expected, alternate land treatment measures which will accomplish the same purposes will be installed. These changes, if necessary, will be made during project installation and will become a part of the Lafayette County Soil and Water Conservation District's long-range program.

Proper management and appropriate land treatment measures are to be applied to 460 acres of forest land. This will principally involve the control of forest land grazing, tree planting, wildlife habitat improvement, and various cultural practices. Marking stands for improvement is a recommended practice for achieving multiple use-sustained yield management on forest lands. Guidance to landowners is to be provided through the preparation of a management plan for forest land to receive protection or treatment measures. Technical assistance is also to be provided during the installation of proposed measures.

Table 1 shows the estimated cost of land treatment measures to be installed within the five year installation period of the project. The total cost of installing these measures, including the cost of technical assistance, is estimated at \$232,590. The status of land treatment applied to date is shown in Table 1A.

### STRUCTURAL MEASURES

The proposed structural measures consist of four floodwater retarding structures and 1.5 miles of small mouth bass stream improvement. Structural data are shown in Table 3. The location of these measures are shown on the project map. Typical structural details are shown on Figure 1.

The four floodwater retarding structures (FRS) are strategically located within the watershed. FRS No. 2 is located on Cottage Inn Branch in the northwest quarter of Section 5, Township 3 North, Range 2 East. FRS No. 3 is located on Bonner Branch in the southwest quarter of Section 18, Township 3 North, Range 2 East. FRS No. 4 is on Wood Branch in the northeast quarter of Section 27, Township 3 North, Range 2 East. FRS No. 8 is on Vinegar Branch in the northeast quarter of Section 5, Township 2 North, Range 3 East.

All four structures will consist of earth fill dams with vegetated earth emergency spillways. Principal spillways will be reinforced concrete pressure pipe outlets with modified single stage riser inlets. See Figure 1 for details. The modified inlet will permit the structures to be operated with a dry or wet sediment pool for fish and wildlife purposes.

The sediment pool is an area allocated to the storage of sediment expected to be deposited throughout the design life of the structure (100 years). Initially this sediment pool area may be used to store water by closing a water control gate. (See Figure 1.) By opening the gate, the water will flow unimpeded through a bottom release pipe. This design allows the sediment pool to be operated either wet (gate closed) or dry (gate open).

Structures 2, 3, and 4 will include fish migration features that will provide a minimum water depth of six inches and a width of eight inches through the bottom release conduit. Difference in

## -Improvements to be Installed-

elevation between the downstream pool level and outlet pipe will be maintained at no greater than one foot. The Wisconsin Department of Natural Resources will be consulted during final design of the structural works for the purpose of incorporating fish and wildlife features.

An ample supply of good quality fill material is available for the embankments. The fill material is primarily Dubuque, Palsgrove, and Orion silt loam soils. These silt loams are primarily silts and clays. The unified soil classifications are ML, CLML, CL, CH and GM. Depth of fill material is limited by bedrock which lies at a depth of three to ten feet in the valley walls and ridge lands.

Foundation materials for the structure sites range from alluvial gravels (GM) of the flood plain with good bearing strength to silt loams (ML, CL-ML, CL) of good to poor bearing strength. All unconsolidated earth materials are underlain by excellent bearing strength bedrock within 25 feet of the surface. Alluvial gravels are found along the streambeds and four to five feet below the surficial silts and clays of the flood plain. The abutments consist of silt loams (ML, CL-ML, CL and CH) over interbedded limestone and dolomite.

The principal spillways for all four sites will be on foundations classified as yielding. Individual structural design features for each site will allow for variable foundation conditions and will eliminate future maintenance problems.

FRS No. 2 will have a maximum height of about 41 feet and a length of 1,050 feet. The site is located about 600 feet below the junction of Whiteside Branch with Cottage Inn Branch. The site is located about 1.2 miles downstream from Joy Lake, which is a 55 acre man-made lake created by an earth fill structure designed by the Soil Conservation Service. The left abutment has a gentle five percent slope, but the right abutment has a steep 30 to 40 percent slope. Land use is grassland with about six mature trees growing on the right abutment. The principal spillway and retarding storage will control the run-off from a flood occurring on the average of once in 50 years (50-year flood). The principal spillway will be 36 inches in diameter. The vegetated earth emergency spillway located on the left abutment will be 300 feet wide. Land rights for the structure, spillways, pool area, and work area will require approximately 138 acres.



FRS No. 3 will have a maximum height of about 37 feet and a length of 950 feet. The site is located about a mile and one-half downstream from the village limits of Belmont on Bonner Branch. The left abutment has a gentle six percent slope, but the right abutment has an average slope of around 20 percent. Land use is grassland and cropland. The principal spillway and retarding storage will control the run-off from a flood occurring on the average of once in 50 years (50-year flood). The principal spillway will be 36 inches in diameter. The vegetated earth emergency spillway located on the left abutment will be 150 feet wide. Land rights for the structure, spillways, pool area, and work area will require approximately 200 acres. Three power poles in the sediment pool will have to be moved.

FRS No. 4 will have a maximum height of about 41 feet and a length of 900 feet. The site is located in Section 27, T. 3N., R. 2E., approximately 2,000 feet above a north-south town road on Wood Branch. The left abutment has a slope of 15 to 20 percent. The right abutment has a fairly uniform nine percent slope. Land use is divided between cropland and grassland. The principal spillway and retarding storage will control the run-off from a flood occurring on the average of once in 50 years (50-year flood). The principal spillway will be 30 inches in diameter. The vegetated earth emergency spillway located on the right abutment will be 115 feet wide. Land rights for the structure, spillways, pool area, and work area will require approximately 100 acres.

FRS No. 8 will have a maximum height of about 38 feet and a length of 840 feet. The site is located about two miles above Darlington on Vinegar Branch. The left abutment has an average slope of about 11 percent. The right abutment has a variable slope ranging from ten to 25 percent. Land use is about equally divided between cropland and grassland. A few scattered trees will be affected. The principal spillway and retarding storage will control run-off from a flood occurring on the average of once in 100 years (100-year flood). The principal spillway will be 30 inches in diameter. The vegetated earth emergency spillway located on the right abutment will be 135 feet wide. Land rights for the structure, spillways, pool area, and work area will require approximately 62 acres. Construction will require the modification of approximately 1,100 feet of County Highway F and moving of two power poles.



-Improvements to be Installed-

FRS No. 8 will have a 100-year wet sediment pool with public access. Minimum sanitation facilities provided by the sponsors, will meet state and local public health requirements.

The four floodwater retarding structures are briefly summarized in the following table.

FLOODWATER RETARDING STRUCTURES

Subwatershed	Site No.	Drainage Area			Storage Capacity		
		Total (sq.mi.)	Controlled (sq.mi.)	Percent Controlled	Floodwater (ac.ft.)	Sediment (ac.ft.)	Total (ac.ft.)
Cottage Inn Branch	2	13.9	8.36	60.1	967	292	1,259
Bonner Branch	3	20.5	9.97	48.6	1,287	481	1,768
Wood Branch	4	18.4	6.07	33.0	712	232	944
Vinegar Branch	8	4.2	2.19	52.1	287	103	390

Additional structural data are shown in Table 3.

All structures have a design life of 100 years. The four proposed structures will provide storage for 1,108 acre-feet of sediment during the 100 year evaluation period. This is equivalent to an average of 0.78 inches of erosion from the controlled drainage area. Floodwater storage capacity of 3,253 acre-feet is equivalent to 2.3 inches of run-off from the controlled area. These structural measures will control 26.59 square miles or 32.6 percent of the total drainage area in the First Capitol Watershed. They will also control 9.7 percent of the drainage area above the city of Darlington.

Investigation has disclosed that under present conditions, the four floodwater retarding structures will not result in the displacement of any person, business, or farm operation.

Small mouth bass stream improvement features will be installed for a distance of 1.5 miles downstream from FRS No. 3 on Bonner Branch. The purpose is to improve the small mouth bass fishery. The result will be increased recreational opportunity for fishermen.

Stream improvements will consist of instream devices and stream-bank stabilization. Instream devices such as bank cover, boulder retards, stump cover and cattle crossings with spawning areas incorporated are proposed. Streambank stabilization includes rock riprapping, sloping and seeding. The entire 1.5 miles will be fenced on both sides at an average distance of 4 rods from the center of the stream (see figure 1a).

Some or all of these measures are semi-permanent and will involve replacement and frequent maintenance to insure effective operation. Maintenance and replacement of these measures will be done by the Wisconsin Department of Natural Resources and the Lafayette County Soil and Water Conservation District through a separate agreement. Installation of these measures is made practical by the flood protection provided by FRS No. 3.

There will be public access from CTH G. The entire 1.5 miles of stream will be made accessible to the public by purchasing or acquiring perpetual easement on a strip averaging 4 rods on each side of the stream. No recreational facilities are planned. The sponsors will provide graveled parking areas for fishermen and minimum sanitary facilities which will meet State and local public health requirements.

Measures to be taken during construction to minimize soil erosion, water, air and noise pollution are those described in the Soil Conservation Service Engineering Memorandum 66, Guidelines for Minimizing Soil Erosion and Water and Air Pollution During Construction; Soil Conservation Service Engineering Memorandum 76, Public Safety at Structural Works of Improvement; and the U.S. Department of Interior Bureau of Reclamation publication, Safety and Health Regulations for Construction. Contractors will be required to adhere to strict guidelines for minimizing soil erosion and water and air pollution during construction. Construction areas will be vegetated during and immediately after construction. Diversions, debris basins and stream crossings will be installed as needed to control pollution.

## -Improvements to be Installed-

Clearing and grubbing of reservoir and structure site areas will be held to a minimum. This will provide for the least change or modification in the environment. Clearing and grubbing will generally be limited to areas subject to cut and fill and within permanent pool areas. Soil Conservation Service Engineering Memorandum WI-11 provides the standards for clearing reservoirs above floodwater retarding dams.

Seeding specifications are outlined in Construction Specification No. 203. Erosion resistant grasses and legumes such as smooth brome, tall fescue, and birdsfoot trefoil, will be specified on a site-by-site basis. Mowing of structure sites and sediment pools will be restricted to prevent damage to nesting habitat; however, mowing will be often enough to maintain good grass cover on the structures.

A systematic intensive surface archeological survey made by the State Historical Society of Wisconsin produced one flint scraper and four waste flakes at the four structure sites. The State Historical Society concluded that completion of the First Capitol Watershed project will not destroy any significant archeological information. If anything of historical or archeological interest is discovered during construction, the National Parks Service and the State Historical Preservation officer will be notified so that necessary salvage can be carried out.

## NONSTRUCTURAL MEASURES

The structural measures do not provide protection to the urban area in Belmont. Even though there are approximately 80 acres in Belmont subject to flooding from the 100-year storm, most of the flood plain area is as yet undeveloped. The plan does not include nonstructural project measures, but it recommends that existing improvements subject to flooding in Belmont be floodproofed to minimize future damage. Floodproofing may include protective dikes and floodwalls; waterproof seals around doors and windows; anchoring objects, such as fuel tanks, to prevent flotation; reinforcement to prevent structural damage; and, moving high risk items, such as electric motors, above anticipated flood elevations. These corrective measures, though not a part of the work plan, are recommended on a site by site basis. The U.S. Department of Agriculture Soil Conservation Service flood hazard study for Belmont will provide the basis for determining potential flooding of existing improvements. It is further recommended that the village adopt a flood plain ordinance which will prevent future development in the flood plain as defined by the flood hazard study.

If these corrective and preventive measures are followed as recommended, urban flood damages in the village of Belmont will be reduced and maintained at an acceptable level.



# EXPLANATION OF INSTALLATION COSTS

Project installation costs are given in Tables 1 and 2. The total cost is \$1,002,210, of which \$232,590 is the cost of establishing land treatment on private land and \$769,620 is the cost of structural measures.

## LAND TREATMENT MEASURES

The estimated cost of land treatment measures is \$215,690 on cropland, grassland and other land measures, and \$16,900 for forest land measures. The cost of establishing the land treatment measures includes the cost of applying the measures and the cost of technical assistance.

The estimated costs of establishing the land treatment measures were based on the current costs for rental of contract equipment, labor, supervision, and materials. Costs of applying land treatment measures will be borne by individual landowners and operators.

Cost of technical assistance was based on similar costs for existing conservation programs in this area. Technical assistance from regular appropriations of the Soil Conservation Service and that needed under an accelerated program will be used to accomplish project objectives.

Through cooperative agreements with the Forest Service, technical assistance will be provided by the Wisconsin Department of Natural Resources for the forest land treatment measures. The cost of the technical assistance for accelerating the application rate of the land treatment measures will be met by P.L. 566 funds. The technical assistance item includes salaries and associated costs of technicians who will assist the owners and operators in applying the measures.

Following is a table showing the P.L. 566 and other fund obligation by years during the installation period. Other costs include technical assistance and application.



## EXPECTED EXPENDITURES FOR LAND TREATMENT

(Dollars)

Year	Crop, Pasture and Other Land			Forest Land		
	P.L. 566	Other	Total	P.L. 566	Other	Total
1	6,670	23,520	30,200	500	2,500	3,000
2	10,960	38,640	49,600	1,000	3,000	4,000
3	11,440	40,330	51,770	1,000	3,000	4,000
4	10,020	35,290	45,300	500	3,000	3,500
5	<u>8,580</u>	<u>30,240</u>	<u>38,820</u>	<u>-</u>	<u>2,400</u>	<u>2,400</u>
TOTAL	47,670	168,020	215,690	3,000	13,900	16,900

## STRUCTURAL MEASURES

The total installation cost for structural measures include cost of construction, engineering services, land rights, relocation payments, and project administration. These installation costs are shown in Tables 1, 2 and 2A.

The construction costs in the engineer's estimate were based on recent contract data for P.L. 566 projects in Wisconsin. The total construction cost includes contingencies of ten to 15 percent.

The cost of engineering services includes services of engineers, hydrologists and geologists for surveys, site investigations, soil mechanics, structural designs, flood routing, and construction plans and specifications. Engineering costs are estimated at ten percent of the construction cost.

Land rights costs were determined through meetings with the sponsoring local organization and concurred in by the Soil Conservation Service. Land rights include cost for land acquisition, easements, rights-of-way, and modification of utilities, roads, and other improvements. Included are elements of work involving construction and engineering services directly associated with land rights. Land rights costs are estimated at \$106,900. Cost for land acquisition, easements and rights-of-way is estimated to be \$79,800. However, this does not preclude the possibility of the purchase or donation of flowage easements in lieu of direct land purchases. Modifications of utilities include moving six power poles at an estimated cost of \$4,000. Road modification involves realigning and raising 1,100 feet of county highway estimated at \$23,100.

Relocation payments include moving and related expenses for a displaced person, business, or farm operations, as well as financial assistance for replacement housing for a displaced person who qualifies and whose dwelling is acquired because of the project. There are no relocation payments involved in this project.

The costs of project administration are the P.L. 566 and other administration costs associated with the installation of structural measures. This includes costs for contract administration, relocation assistance advisory services, review of engineering plans prepared by others, government representatives, construction layout, and necessary inspection service during construction to insure that structural measures are installed in accordance with the plans and specifications. Project administration costs for P.L. 566 and other funds are estimated at 15 percent and two percent of the construction cost respectively. No relocation assistance advisory services are anticipated because there are no relocations involved in this project. If needed, these services will be provided by the sponsors.

The expected expenditures of funds by fiscal years for the installation of structural measures during the five year period is shown on the following table.

-Installation Costs-

EXPECTED EXPENDITURES OF FUNDS FOR STRUCTURAL MEASURES BY FISCAL YEARS

First Captiol Watershed, Wisconsin

(dollars)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>Total</u>
<u>P.L. 566 Funds</u>						
Construction	0	215,660	139,840	120,500	27,600	503,600
Engineering Services	34,140	12,050	0	0	0	46,190
Land Rights	0	0	0	0	0	0
Project Administration	<u>0</u>	<u>32,350</u>	<u>20,970</u>	<u>18,080</u>	<u>550</u>	<u>71,950</u>
Total-P.L. 566 Funds	34,140	260,060	160,810	138,580	28,150	621,740
<u>Other Funds</u>						
Construction	0	0	0	0	27,600	27,600
Engineering Services	0	0	0	0	2,760 <sup>1/</sup>	2,760
Land Rights	44,750	51,150	8,000	3,000	0	106,900
Project Administration	<u>0</u>	<u>4,310</u>	<u>2,800</u>	<u>2,410</u>	<u>1,100</u>	<u>10,620</u>
Total-Other Funds	<u>44,750</u>	<u>55,460</u>	<u>10,800</u>	<u>5,410</u>	<u>31,460</u>	<u>147,880</u>
TOTAL	78,890	315,520	171,610	143,990	59,610	769,620

<sup>1/</sup> To be furnished by the Wisconsin Department of Natural Resources.

**COST SHARING**

Installation costs will be shared by the local sponsoring organization and the federal government in accordance with the requirements of Public Law 566, as amended, and the Secretary's Policy Statement.

The total estimated installation cost of the project is \$1,002,210, of which \$672,410 are from P.L. 566 funds and \$329,800 are from other funds.



### P.L. 566 FUNDS

The following will be borne by P.L. 566 funds:

1. The cost of technical assistance needed to accelerate the application of land treatment measures (estimated cost \$50,670).
2. The construction cost of the structural measures for flood prevention incurred by the federal government (estimated cost \$476,000).
3. The construction cost of small mouth bass stream improvements incurred by the federal government (estimated cost \$27,600).
4. The cost of engineering services for flood prevention measures (estimated cost \$46,190).
5. Project administration costs incurred by the federal government (estimated cost \$71,950).

### OTHER FUNDS

The following costs will be borne by other funds:

1. The cost of installing land treatment measures (estimated cost \$166,900).
2. Cost of technical assistance for the existing land treatment program (estimated cost \$15,020).
3. The cost of construction for the small mouth bass stream improvements incurred by the Wisconsin Department of Natural Resources (estimated cost \$27,600).
4. The total cost of the engineering services for the small mouth bass stream improvements by the Wisconsin Department of Natural Resources (estimated cost \$2,760).
5. Project administration cost incurred by the sponsors (estimated cost \$10,620).
6. Total cost of land rights for the structural measures (estimated cost \$106,900).



# EFFECTS OF WORKS OF IMPROVEMENT

## FLOOD PREVENTION, EROSION, AND SEDIMENT

Land treatment measures on the uplands will reduce cropland sheet and gully erosion from 5.8 to 3.5 tons per acre per year. Water retention capability of upland areas will be increased, resulting in an over-all reduction in surface run-off volume. Land treatment measures to be installed by individual farm owners and operators will provide the following benefits:

1. All types of erosion will be reduced. It is estimated that land treatment measures to be installed during the five year installation period will reduce cropland sheet and gully erosion by 2.3 tons per acre per year. This is a decrease of 40 percent. A similar decrease will occur for other agricultural land uses.
2. Damage from sedimentation will be reduced. Reduction in erosion will be accompanied by a corresponding reduction in sedimentation. This reduction will be supplemented by the trap efficiency of the four floodwater retarding structures. It is estimated that sediment reaching the Pecatonica River from the watershed will be reduced by 45 to 55 percent of the present estimated rate of 14.4 acre-feet per year.
3. Soil moisture and ground water recharge will be increased through improved hydrologic characteristics. Water retention (precipitation minus run-off) will be increased.
4. Productive land, a prime national resource, can be used more wisely and within its capability.
5. Crop production required to support the basic economy of the watershed community will be maintained.
6. Installation of forest land treatment measures and intensified multiple use management will enhance recreation and wildlife values, and contribute substantially to beautification, aesthetic appeal, environmental quality and future use of the woodland resources.

7. Costs of maintaining structural works of improvement will be reduced by the installation of land treatment measures above structure sites.
8. Wildlife habitat will be protected and enhanced.
9. Flood prevention benefits through reduced run-off and reduced sediment production will occur throughout the watershed.
10. The city of Darlington and the Pecatonica flood plain adjacent to the First Capitol Watershed will receive significant incidental flood prevention benefits.

Proposed land treatment measures to be installed during the project period will provide onsite benefits on approximately 10,500 acres of cropland or grassland, 460 acres of forest land, and 650 acres of other land. The total acreage receiving onsite benefits, 11,610 is about 22 percent of the 52,198 acres in the First Capitol Watershed.

Structural works of improvement to supplement land treatment measures will protect 1,600 of the 2,730 flood plain acres in the watershed. Structural measures will reduce floodwater and sediment damages by amounts ranging from a minimum of 36 percent to a maximum of 99 percent in the benefited area.

Damage reduction in the city of Darlington, which is partially within the watershed area will be incidental to the project. Complete protection of the city is not possible because the watershed area includes less than one-third of the total drainage area above the city. Remaining damages will be minimized if the U.S. Army Corps of Engineers design and construct a local flood control project in Darlington as authorized by Congress in the Flood Control Act of 1962. Structural measures will also provide incidental flood reduction benefits in a portion of the Pecatonica flood plain adjacent to the watershed.

Works of improvement will reduce flood peaks to varying degrees throughout the watershed depending on the proximity of structures, percent of control, and magnitude of the storm.

PEAK DISCHARGES IN CUBIC FEET PER SECOND

	100 Year		5 Year	
	Without	With	Without	With
<u>Bonner Branch</u>				
Cottage Inn Site	5,900	160	2,400	130
Bonner Branch (Belmont Arm)	4,420	155	1,825	130
Confluence of Cottage Inn and Bonner Branches	8,700	5,420	3,510	2,000
At Pecatonica River Confluence	7,360	4,150	2,960	1,640
<u>Wood Branch</u>				
Site	2,925	110	1,160	95
At Pecatonica River Confluence	6,200	5,445	2,450	2,100
<u>Vinegar Branch</u>				
Site	1,630	85	670	68
At Pecatonica River Confluence	2,080	1,640	825	585

Structural measures will provide minimum levels of flood protection ranging up to a 20 year frequency flood. Reach A on Cottage Inn Branch from FRS No. 2 to the first downstream tributary will be protected from a 20-year frequency flood or better. Reach B from the end of reach A to the confluence with Bonner Branch will have minimum protection from a storm expected to occur on the average of once every two years. Reaches C and D on Bonner Branch from FRS No. 3 to the Pecatonica River will receive annual or better protection. Reach E on Wood Branch from FRS No. 4 to about two miles downstream will receive two year frequency flood protection or better. Annual or better protection



will be provided for reaches F and G on Wood Branch from the end of reach E to the Pecatonica River. Reach H on Vinegar Branch from FRS No. 8 to the Pecatonica River will receive protection from a two year frequency flood or better.

The above levels of protection are minimums. Many portions of the reaches discussed will have a much higher level of protection.

In areas near proposed structures a near 50 to 100-year level of protection will be approached.

The four structures will control 32.6 percent of the watershed and about 9.7 percent of the total drainage area above the city of Darlington. Approximately 1,600 acres of flood vulnerable land within the watershed will be benefited by having the depth of flooding and the area flooded reduced. Reductions in area flooded within the benefited area of the watershed for 24-hour duration storms are shown in the following table.

<u>Storm</u>	<u>Area Flooded Below Structures (Acres)</u>	
	<u>Without Project</u>	<u>With Project</u>
2-Year	725	140
5-Year	1,185	670
10-Year	1,360	900
100-Year	1,600	1,295

For the key flood studied (25-year frequency storm) the area flooded within the watershed will be reduced from about 1,440 acres to 1,010 acres with the installation of the project measures. About 33 rural landowners will be directly benefited by the project. Over-all, the estimated damages for the key flood will be reduced \$127,000.

Additional significant damage reduction would be realized outside the watershed in the agricultural flood plain of the Pecatonica River from Calamine downstream to about four miles below Darlington. Approximately 35 rural landowners will benefit from crop, pasture, and rural property damage reduction on about 2200 acres of agricultural land in the Pecatonica River flood plain.



In addition, benefits to the city of Darlington would be realized from peak reduction. About 12 residences, 62 retail businesses, a county fairgrounds, city fire station, transformer station, and railroad yard will be benefited. It is estimated that damages will be reduced over 11 percent in Darlington. The level of protection to the Pecatonica flood plain and Darlington was determined from existing data developed by the Corps of Engineers.

With the installation of the project, over 100 acres of flood vulnerable pasture could be converted to cropland. This could trigger associated land use adjustments which would promote good conservation farming. For example, cropland on steep slopes could be converted to pasture or forest land.

Benefits will accrue at 12 bridge locations because of reduced road and bridge repairs, savings in bridge replacement costs, and the elimination of road closures during flood events. Water supply and waste disposal systems, public utilities, etc., will also be protected from flooding.

Sediment deposition will be reduced below the proposed floodwater retarding structures. Sediment reduction will improve water quality and enhance fish and wildlife habitat.

The project will provide flood damage reduction benefits of about \$46,050 each year. It is estimated that average annual damages within the benefited area of the watershed will be reduced about 67 percent. In addition, average annual damages in the Pecatonica River flood plain and in the city of Darlington will be reduced by about 11 percent.

Each of the floodwater retarding structures is designed in such a manner that the sediment pool can be either wet or dry. The versatility of having either wet or dry sediment pools will enhance fish and wildlife habitat management. It is the sponsors' intent to operate Sites No. 2, No. 3, and No. 4 with dry sediment pools.

Floodwater retarding structure No. 8 on Vinegar Branch will have a 100-year wet sediment pool. An 18 acre lake with a maximum depth of 20 feet will be created in an area where there are few natural lakes. Public access will be provided to the site. Sanitary facilities will be provided. Incidental recreational benefits will be realized for public hunting and fishing. The wet sediment pool will enhance aquatic wildlife habitat with the initial creation of about five acres of wetlands. The monetary value of incidental recreation was not evaluated.

## AGRICULTURAL WATER MANAGEMENT

Neither irrigation nor drainage features are included in the structural works of improvement. Although some interest was expressed in the application for assistance, adequate water supplies for irrigation and drainage outlets exist.

## WATER SUPPLY

There is no proposed water supply, new or supplemental, to be developed in this project.

## FISH AND WILDLIFE AND RECREATION

Stream channel characteristics will be modified on 1.5 miles of stream below FRS No. 3 on Bonner Branch. Small mouth bass stream improvement features will be installed to enhance the existing fishery. Both instream devices and bank stabilization features are planned. The effect will be to increase fish populations and to provide additional recreational opportunity for fishermen. The fisherman capacity is estimated to be 20 per mile or 30 fishermen at any one time.

Following project installation, recreation visits are expected to increase from 400 to about 2,470 annually. The primary use season extends from May through November with the greatest use occurring during July and August. The value per fisherman visit is estimated at \$3.00 because of the limited and unique opportunity for quality small mouth bass fishing in Wisconsin.

About one-half mile of perennial stream will be inundated by the wet sediment pool at FRS No. 8 on Vinegar Branch. An additional 0.3 miles of stream channel is within the temporary floodwater retarding pool. An additional 190 feet of stream will be replaced by pipe flow through the dam and an estimated 250 feet of channel below the structure will be modified as an outlet.

About 13 acres of cropland and 11 acres of grassland will be destroyed by the installation of FRS No. 8. An 18 acre lake, including about five acres of wetlands, will be created. Land use in the 21 acre temporary flood retarding pool will probably be unchanged except for an area acquired for public access.

About one mile of perennial stream will be within the dry sediment pool area at FRS No. 2 on Cottage Inn Branch. An additional 1.4 miles of stream channel is within the temporary floodwater retarding pool. About 235 feet of stream will be replaced by pipe flow through the dam and an estimated 200 feet of channel below the structure will be modified as an outlet. A migration tube will be installed to provide for the free movement of fish above and below the dam.

The dam and emergency spillway will occupy about ten acres of land. Present land use in the 36 acre dry sediment pool is grassland. The 75 acre temporary floodwater retarding pool is currently used for grassland and a small amount of cropland. No change in land use is expected after installation of the structure.

About 0.8 mile of perennial stream will be within the dry sediment pool at FRS No. 3 on Bonner Branch. An additional mile of stream channel is within the temporary floodwater retarding pool. About 210 feet of stream will be replaced by pipe flow through the dam and an estimated 450 feet of channel below the structure will be modified as an outlet. A migration tube will be installed to provide for the free movement of fish above and below the dam.

The dam and emergency spillway will occupy about six acres of land. Present land use in the 67 acre dry sediment pool is grassland. The 100 acre temporary floodwater retarding pool is currently used for grassland and cropland in about equal amounts. No change in land use is expected after installation of the structure.

About 0.6 mile of perennial stream will be within the dry sediment pool at FRS No. 4 on Wood Branch. An additional three quarters of a mile of stream channel is within the temporary floodwater retarding pool. About 225 feet of stream will be replaced by pipe flow through the dam and an estimated 400 feet of channel below the structure will be modified as an outlet. A migration tube will be installed to provide for the free movement of fish above and below the dam.



The dam and emergency spillway will occupy about six acres of land. Present land use in the 28 acre dry sediment pool is mostly cropland. The 42 acre temporary floodwater retarding pool is currently used for cropland and grassland in about equal amounts. Land use in the sediment pool will be changed from cropland to grassland. No change in land use is expected in the retarding pool.

No known rare or endangered species will be affected by the project.

### ARCHEOLOGICAL, HISTORICAL, AND SCIENTIFIC

There are no archeological, historical or scientific sites, properties, or similar values which will be affected by the project. The site of the first capitol and legislative buildings for Wisconsin, which is listed in the National Register of Historic Places, will not be affected by the project. Areas determined to be of state natural area significance will not be affected by flood control structures or other construction as outlined in this work plan.

### GENERAL

The installation of the dams, spillways and sediment pools will affect approximately 177 acres of agricultural land along with the associated upland game habitat. An additional 238 acres within the retention pools will be subject to periodic flooding.

Twenty four acres of grassland adjacent to the smallmouth bass stream improvement will be removed from agricultural production and used for wildlife habitat and public access.

The First Capitol Watershed will gain five acres of wetlands and 18 acres of lake surface as a result of the project. Approximately 1.5 miles of small mouth bass fishery will be directly improved by the project. The fishery on all the streams in the benefited area will be improved as the result of decreased floodwater and sediment damage.

Fish and wildlife habitat will experience a net gain as a result of the project. The quality of man's environment will be improved with the reduction of flood damages. His economic well being will also be improved as described in the following sections of this plan.

## PROJECT BENEFITS

Project works of improvement, including land treatment and structural measures, will reduce estimated average annual direct and indirect floodwater damages within the benefited area of the watershed from \$35,780 to \$11,670. This is a reduction of 67 percent (Table 5). Flood damage reduction benefits in the Pecatonica River flood plain from Calamine to a point about four miles below Darlington will be \$21,940.

Direct average annual primary benefits accruing from the reduction of floodwater damage to crop and pasture land are estimated at \$9,830. Those benefits attributable to a reduction in damage to farm buildings, fences, farm machinery, and farm roads and bridges are expected to be \$4,550.

Estimated direct annual benefits from the reduction of floodwater damages to roads and bridges are \$6,910.

Indirect benefits are estimated at \$2,820 annually. These benefits were estimated at ten percent of total agricultural direct benefits and 20 percent of road and bridge benefits. Additional information about indirect benefits is discussed in the Investigations and Analyses section.

The estimated direct and indirect damage reduction benefits within the watershed from project installation will total \$24,110 annually. Of this amount, land treatment will provide \$1,230 in damage reduction benefits.

Damage reduction benefits from outside the watershed are expected to total \$21,940 annually. These benefits will result from a reduction of floodwater damages to the city of Darlington and to cropland and pasture and rural property along the Pecatonica River flood plain.

Total average annual direct and indirect damage reduction benefits inside and outside the watershed boundaries from the installation of project measures will be \$46,050.

Anticipated annual benefits from land conversion because of the project are \$2,120. It is expected that land conversion benefits will occur on 104 acres. This land, now pasture, is not presently cropped due to the hazard of frequent flooding. It is expected that this land will be put under cultivation following installation of the project measures.

Recreation benefits from the 1.5 miles of small mouth bass stream improvement were estimated at \$6,200 annually.

Secondary benefits accruing from the project were estimated at \$5,700 on an average annual basis. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

Total project benefits from all categories will be \$58,840. Of this amount, \$52,380 are flood prevention benefits and \$6,460 are benefits from recreational opportunities created by the small mouth bass stream improvement on Bonner Branch.

## COMPARISON OF BENEFITS AND COSTS

The structural measures outlined in this plan are economically feasible. The average annual benefits to accrue as a result of the installation of the proposed structural measures are estimated to be \$58,840. Average annual benefits accruing to the project are \$53,140 primary, and \$5,700 secondary. The average annual cost of the proposed structural measures is estimated to be \$45,630. The ratio of average annual benefits, including secondary benefits, to average annual cost is 1.3 to 1.0. The ratio of average annual benefits, without secondary benefits, to average annual cost is 1.2 to 1.0. Table 6 shows a comparison of annual benefits to annual costs.



# PROJECT INSTALLATION

Execution of this work plan will be a joint undertaking of nonfederal and federal interests. Nonfederal interests include the Lafayette County Soil and Water Conservation District, and the Wisconsin Department of Natural Resources. Federal agencies involved with the project are the Agricultural Stabilization and Conservation Service, the Forest Service, and the Soil Conservation Service, of the U.S. Department of Agriculture.

In order to coordinate the installation of accelerated land treatment measures and structural measures provided for in this plan, close cooperation and specific responsibilities are required of private interests, the sponsors and federal agencies assisting with the project. The Lafayette County Soil and Water Conservation District will have primary responsibility for accomplishing the plan. They will:

1. Provide technical assistance to landowners and operators in the watershed to assure the application of land treatment measures outlined in this plan.
2. Conduct an information and education program as needed to properly inform local people of the project.
3. Obtain cooperative agreements with individual farmers to install land treatment measures during the project period.
4. Carry out and assume the responsibility and all liability for the construction, operation and maintenance of structural measures.
5. Acquire all land rights needed in connection with the works of improvement. The power of eminent domain will be exercised if necessary. The power of eminent domain for purposes of flood prevention and recreation is vested in county soil and water conservation districts under Sec. 92.08(3), Wisconsin Statutes.
6. Be responsible for providing sanitary facilities which will meet minimum state and local requirements when public access is provided.

7. Comply with the real property acquisition policies and regulations contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.
8. Act as contracting organization for the construction of all structural measures.

The Lafayette County Soil and Water Conservation District will be responsible for the following items; however, it is expected that they will be performed by the Wisconsin Department of Natural Resources through a separate agreement with the SWCD.

1. Furnish the Soil Conservation Service with design criteria and provisions required for proper operation and management of water resources, and water and land as related to fish and wildlife.
2. Provide public access, parking, and sanitation facilities for the small mouth bass stream improvement.
3. Provide, subject to concurrence by the Soil Conservation Service, all necessary engineering services, plans and specifications, required for the installation of the stream fishery improvements.
4. Install the stream fishery improvements.

The Agricultural Stabilization and Conservation Service will:

Provide federal cost sharing assistance in accordance with existing Agricultural Stabilization and Conservation Service policies and procedures to individual landowners in applying approved conservation practices.

The Forest Service will:

Through cooperative agreements with the Wisconsin Department of Natural Resources, Bureau of Forest Management, furnish technical assistance for forest land treatment measures to be installed by landowners.

The Soil Conservation Service will:

1. Furnish technical assistance through the Lafayette County Soil and Water Conservation District to landowners for the application of the land treatment measures outlined in this work plan.
2. Furnish engineering services for engineering surveys, design, land rights work map, construction plans and specifications for structural works of improvement for flood prevention and inspection during construction.
3. Allot P.L. 566 construction funds in accordance with cost sharing and the installation schedule outlined in this plan or as may be revised by mutual consent. Allocations of funds will be in accordance with national priorities and availability at the time of installation.
4. Maintain liaison with sponsors, state and federal agencies involved so that the objectives outlined in this plan will be accomplished.
5. Inspect the stream fishery improvement to determine acceptance for payment.

Construction of structural works of improvement for single purpose flood prevention structures will be accomplished by formal contracts. All contracts will be awarded on the basis of competitive bid by qualified bidders.

Installation of the stream fishery improvement will be accomplished by the Wisconsin Department of Natural Resources. This work will be done through an agreement with the Lafayette County Soil and Water Conservation District and be subject to approval by the Soil Conservation Service.

Project agreements will be executed by the sponsors and the Soil Conservation Service for each contract unit of work. Prior to the execution of such an agreement, all land, easements, and rights-of-way will be obtained and properly recorded by the sponsoring local organization in their county.

A five year installation period is planned for the project. The land treatment measures will be applied throughout the installation period. The construction schedule is as follows:



<u>Year</u>	<u>Works of Improvement</u>
First	Obtain land rights and complete designs for floodwater retarding structures Numbers 2, 4 and 8.
Second	Construct floodwater retarding structures Numbers 4 and 8, obtain land rights and complete design for floodwater retarding structure Number 3.
Third	Construct floodwater retarding structure Number 2, obtain land rights for stream fishery improvement.
Fourth	Construct floodwater retarding structure Number 3, design stream fishery improvement.
Fifth	Install stream fishery improvement.

## FINANCING PROJECT INSTALLATION

Project installation costs allotted to P.L. 566 will be paid from funds appropriated under the authority of P.L. 566, 83rd Congress; 68 Stat. 666, as amended. This work plan does not constitute a financial document for obligation of federal and other funds.

Financial or other assistance to be furnished by the Service or the Wisconsin Department of Natural Resources in carrying out the plan is contingent upon the appropriation of funds for this purpose.

The cost of installing land treatment measures will be borne by the individual landowners or operators with such financial assistance as may be available from federal and state funds.

The Soil Conservation Service will continue to provide technical assistance for land treatment at the present rate under the ongoing program. P.L. 566 funds will be used to accelerate land treatment during the project installation period.

Forest land treatment measures will be installed, using private and public funds. They will be implemented through the ongoing Cooperative Forestry Programs and through an accelerated P.L. 566 program. Technical assistance will be cost-shared between the Forest Service and the Wisconsin Department of Natural Resources.

The installation costs for structural measures not borne by P.L. 566 funds will be the responsibility of the Lafayette County Soil and Water Conservation District. The district has analyzed its financial needs in consideration of the scheduled works of improvement so that funds will be available when needed. The local sponsors' share of the installation cost referred to as land acquisition, easements, and rights-of-way will be negotiated for or acquired by eminent domain.

The Lafayette County Board has provided funds on an annual basis to the County Soil and Water Conservation District for this project. The District has on deposit \$75,000 to be used to meet its share of the project installation cost. The First Capitol Watershed Association may accept and provide to the District cash or land rights donations.

# PROVISIONS FOR OPERATION AND MAINTENANCE

## LAND TREATMENT

Landowners and operators cooperating with the County Soil and Water Conservation District will be responsible for the maintenance of land treatment measures installed on their land. Technical assistance will be available from the Wisconsin Department of Natural Resources, Bureau of Forest Management, in cooperation with the U.S. Forest Service and the U.S. Soil Conservation Service.

## STRUCTURAL MEASURES

The Lafayette County Soil and Water Conservation District will operate and maintain all structural works of improvement after they are installed. The District has obtained commitments from the Lafayette County Board that the Board will furnish necessary funds for operation, maintenance and replacement of all works of improvement installed under this plan. This commitment is in the form of a resolution passed by the County Board. The sponsoring local organization may enter into agreements with other entities to carry out the operation and maintenance activities.

The sponsoring local organization is responsible for the proper operation and maintenance, without cost to the federal government, of works of improvement which are installed in part with Public Law 566 funds and for which there will be a continuing need for operation and maintenance. They are also responsible for obtaining all necessary permits.

The structural measures for flood prevention are automatic in operation and require no manual operation to achieve the level of flood protection outlined in this plan. Operation of the gated sediment pools (either wet or dry) will be stated in agreements with the Wisconsin Department of Natural Resources when permits are applied for. Specific items necessary for the operation and maintenance of the flood retarding structures shall include, but are not limited to the following:



## -Operation and Maintenance-

1. Periodic maintenance will be required to insure proper functioning of the structural works.
2. All structures are to be maintained by making repairs or replacements as needed.
3. Obstructions, trash and debris are to be moved from the principal spillway inlets, outlets and other structural works during and immediately after storm events.
4. Repairs to structures or structural features damaged by floods will be made promptly.
5. A drainage gradient will be maintained through the dry sediment pools so that no stagnant pools are formed. This must be done to eliminate potential health hazards and mosquito breeding areas.
6. Mowing of the structure sites and sediment pools will be restricted to prevent damage to nesting habitat; however, mowing will be often enough to maintain good grass cover on the structures. In addition, spot control of noxious weeds may be necessary. This could be accomplished by mowing or spraying.

Stream fishery improvement features will involve replacement and frequent maintenance to insure effective operation. The Lafayette County Soil and Water Conservation District who has responsibility for operation and maintenance will enter into a separate O&M agreement with the Wisconsin Department of Natural Resources prior to the installation of stream fishery improvement features. The basis for such an agreement is documented in the minutes of the Lafayette County Soil and Water Conservation District meeting dated June 12, 1973. The Wisconsin Department of Natural Resources will operate, maintain, and replace instream devices and bank stabilization measures. It will also provide vegetative control of woody plants. The Lafayette County Soil and Water Conservation District will maintain the fences and provide noxious weed control.

Specific items necessary for operation and maintenance of the stream fishery improvement features on Bonner Branch shall include, but are not limited to the following:

1. Periodic maintenance will be required to insure proper functioning of instream devices.
2. Bank stabilization features are to be maintained by making repairs or replacements as needed.

3. Obstructions, trash, and debris are to be removed from the channel.
4. Parking facilities must be kept in usable condition.
5. Rental of sanitary facilities that will meet state and local public health requirements will be included in the operation cost.

Total annual operation, maintenance, and replacement cost of structural measures is estimated to be \$3,110. This includes \$1,140 for the four single purpose floodwater retarding structures and \$1,970 for the 1.5 miles of small mouth bass stream fishery improvement on Bonner Branch.

The stream fishery improvement includes \$400 for routine annual operation and maintenance, and \$300 for the annual rental of portable sanitary facilities. Average annual replacement cost of instream devices and bank stabilization measures is \$1,270.

For a period of three years following installation of each structural measure, the Chairman of the Soil and Water Conservation District Supervisors, President of the First Capitol Watershed Association, Chairman of the Highway Committee of the County Board and a representative of the Soil Conservation Service will make a joint annual inspection. Annual inspections following the third year will be made by the Chairman of the Soil and Water Conservation District Supervisors, President of the First Capitol Watershed Association and the Chairman of the Highway Committee of the County Board. A report will be sent to the designated Soil Conservation Service representative. Inspections, including a report, will also be made after floods or after the occurrence of any situation which might adversely affect the operation of any of the structural measures. Inspections will cover all portions of each structure, channel below, ponded area above and the stream fishery improvement.

The annual and severe storm maintenance inspections will include the determination of vector breeding areas. Those areas caused by the project that might pose a public health threat or nuisance to the public will be eliminated.

The installation and operation and maintenance of the planned works of improvement must meet the requirements of the Wisconsin Department of Health and Social Services and the Health, Education and Welfare Committee of the Lafayette County Board.

Representatives of the federal, state and county governments shall have free access at all times to the structural works of improvement for official activities. All phases of operation and maintenance of these facilities shall comply with applicable local, state and federal regulations.

All operation and maintenance agreements must be executed prior to the signing of the land rights agreement or the project agreement for construction of structural measures. A separate operation and maintenance agreement will be prepared for each structural measure.

Each operation and maintenance agreement will contain a reference to the State of Wisconsin Watershed Operation and Maintenance Handbook for Projects Installed With Assistance from the Soil Conservation Service. An operation and maintenance plan will be prepared for each structural measure.



TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

## First Capitol Watershed, Wisconsin

Installation Cost Item	Unit	No. Non-Federal Land	Estimated Cost (Dollars) 1/						Total*
			P.L. 566			Other			
			Nonfederal Land			Nonfederal Land			
			SCS 4/	FS 4/	Total	SCS	FS	Total	
LAND TREATMENT									
Land Areas 3/									
Cropland	Acres	6,500				64,760		64,760	64,760
Grassland	to be	4,000				61,200		61,200	61,200
Forest Land	treated	460					12,300	12,300	12,300
Other		650				6,640		6,640	6,640
Technical Assistance			47,670	3,000	50,670	13,420	1,600	15,020	65,690
TOTAL LAND TREATMENT			47,670	3,000	50,670	166,020	13,900	161,920	232,590
STRUCTURAL MEASURES									
Construction									
Floodwater Retarding Structure	Each	4	476,000		476,000				476,000
Small Mouth Bass Stream Improvement	Miles	1.5	27,600		27,600	27,600		27,600	55,200
Subtotal - Construction			503,600		503,600	27,600		27,600	531,200
Engineering Services			46,190		46,190	2,760		2,760	46,950
Project Administration									
Construction Inspection			47,590		47,590				47,590
Other			24,360		24,360	10,620		10,620	34,980
Subtotal - Administration			71,950		71,950	10,620		10,620	62,570
Other Costs									
Land Rights						106,900		106,900	106,900
Subtotal - Other						106,900		106,900	106,900
TOTAL STRUCTURAL MEASURES			621,740		621,740	147,680		147,680	769,620
TOTAL PROJECT			669,410	3,000	672,410	315,900	13,900	329,800	1,002,210

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1/ Price Base - 1972

2/ No federal land within the watershed

3/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed and dollar amounts to apply to total land areas, not just to adequately treated areas.

4/ Federal agency responsible for assisting in installation of works of improvement.



TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

(As Of April 1, 1973)

## First Capitol Watershed, Wisconsin

MEASURES	UNIT	APPLIED TO DATE	TOTAL COST DOLLARS <u>1/</u>
<u>LAND TREATMENT</u>			
Soil Conservation Service			
Conservation Cropping System	acre	12,072	12,072
Contour Farming	acre	15,391	15,391
Critical Area Planting	acre	25	7,500
Diversion	feet	74,640	11,196
Pond	number	11	35,750
Floodwater Retarding Structure	number	7	15,400
Grade Stabilization Structure	number	16	18,240
Grassed Waterway and Outlet	acre	50	30,000
Minimum Tillage	acre	1,000	1,450
Pasture and Hayland Management	acre	10,350	51,750
Pasture and Hayland Planting	acre	700	28,000
Streambank Protection	feet	6,040	3,020
Strip Cropping	acre	9,700	38,800
Drainage Field Ditch	feet	8,750	1,315
Tile Drain	feet	31,760	11,116
Tree Planting	acre	31	1,700
Terracing	feet	6,975	7,000
Multiple Purpose Structures	number	2	85,000
Forest Service			
Fire Control	acre	5,742	5,700
Tree Planting	acre	33	2,000
Hydrologic Stand Improvement	acre	47	1,500
Woodland Grazing Control	acre	358	13,200
Management Plans (10)	acre	145	4,600
TOTAL LAND TREATMENT			401,700

1/ Price Base - 1972

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TABLE 2 - ESTIMATED STRUCTURAL COST OF DISTRIBUTION

First Capitol Watershed, Wisconsin

(Dollars) 1/

Item	Installation Cost P.L. 566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Land Rights	Construction	Engineering	Land Rights	
Floodwater Retarding Structures:							
(2) Cottage Inn Br.	139,840	12,580	-	-	-	18,900	171,320
(3) Bonner Br.	120,500	12,050	-	-	-	30,050	162,600
(4) Wood Br.	106,720	10,670	-	-	-	16,100	133,490
(8) Vinegar Br.	108,940	10,890	-	-	-	33,850	153,680
Subtotal	476,000	46,190	-	-	-	98,900	621,090
Small Mouth Bass Stream Improvement	27,600	-	-	27,600	2,760	8,000	65,960
Subtotal	27,600	-	-	27,600	2,760	8,000	65,960
Installation Subtotal	503,600	46,190	-	27,600	2,760	106,900	687,050
Project Administration	-	-	-	-	-	-	82,570
GRAND TOTAL	503,600	46,190	-	27,600	2,760	106,900	769,620

1/ Price Base - 1972

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TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

First Capitol Watershed, Wisconsin

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING				
	PURPOSE			P.L. 566		OTHER		
	Flood Prevention	Fish and Wildlife	Total	Flood Prevention	Fish and Wildlife	Flood Prevention	Fish and Wildlife	Total
Floodwater Retarding Structures (4)	621,090		621,090	522,190		98,900		98,900
Small Mouth Bass Stream Improvement		65,960	65,960		27,600		38,360	38,360
GRAND TOTAL	621,090	65,960	687,050	522,190	27,600	98,900	38,360	137,260

1/ Price Base - 1972

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TABLE 3 - STRUCTURAL DATA

## STRUCTURES WITH PLANNED STORAGE CAPACITY

First Capitol Watershed, Wisconsin

Item	Unit	Cottage Inn Branch No. 2	Bonner Branch No. 3	Wood Branch No. 4	Vinegar Branch No. 8	Total
Class of Structure						
Drainage Area		b	a 1/	a 1/	c	
Controlled	Sq. Mi.	8.38	9.97	8.07	2.19	28.59
Curve No. (1 day) (AMC II)		71	72	70	70	
Elevation Top of Dam	Ft.	970.8	988.0	927.7	910.0	
Elevation Crest Emergency Spillway	Ft.	985.2	993.0	922.5	902.0	
Elevation Crest High Stage Inlet	Ft.	951.2	981.6	908.0	891.8	
Maximum Height of Dam	Ft.	40.8	37.0	40.7	38.0	
Volume of Fill	Cu. Yds	95,710	74,500	78,420	71,500	318,130
Total Capacity 2/	Ac. Ft.	1,259	1,788	944	390	4,381
Sediment Submerged	Ac. Ft.	65	140	88	30	323
Sediment Aerated	Ac. Ft.	207	341	184	73	785
Retarding	Ac. Ft.	987	1,287	712	287	3,253
Surface Area						
Sediment Pool 3/	Acres	38.0	67.0	30.0	18.0	151.0
Retarding Pool	Acres	111.0	185.0	88.0	42.0	386.0
Principal Spillway Design						
Runoff Volume (1 day)	Inches	2.45	2.45	2.45	2.72	
Runoff Volume (10 day)	Inches	8.12	8.12	8.12	8.80	
Capacity of High Stage (Maximum)	cfs	188	159	110	98	
Frequency Operation-Emer. Spillway	% Chance	2	2	2	1	
Dimensions of Conduit	cfs or Inches	38	38	30	30	
Emergency Spillway Design						
Rainfall Vol. (ESH) (Areal)	Inches	8.91	5.70	5.70	9.70	
Runoff Vol. (ESH)	Inches	3.83	2.75	2.57	5.98	
Storm Duration	Hours	8	8	8	8	
Type	Veg.		Veg.	Veg.	Veg.	
Bottom Width	Ft.	300	150	115	135	
Velocity of Flow (Ve)	Ft./Sec.	8.7	2.0	1.4	7.3	
Slope of Exit Channel	Ft./Ft.	0.03	0.04	0.04	0.0275	
Max. Reservoir Water Surface Elev.	Ft.	987.4	993.5	923.0	904.5	
Freeboard Design						
Rainfall Vol. (FH) (Areal) (Hrs.)	Inches	12.50	9.70	9.70	24.75	
Runoff Volume (FH)	Inches	8.85	8.22	5.98	20.25	
Storm Duration	Hours	8	6	8	8	
Max. Reservoir Water Surface Elev.	Ft.	970.8	997.9	927.5	910.0	
Capacity Equivalents						
Sediment Volume	Inches	0.89 4/	0.90	0.71	0.88	
Retarding Volume	Inches	2.17	2.42	2.20	2.48	

1/ Retarding storage was determined by using class b criteria. Emergency spillway size and height of dam were determined by using class a plus class b criteria.

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2/ Crest of Emergency Spillway.

3/ Risers will be constructed to 100 year sediment elevations for which these acreages apply. All structures may be operated either wet or dry.

4/ From Uncontrolled Area below Joy Lake.





TABLE 4 - ANNUAL COST

First Capitol Watershed, Wisconsin

(Dollars) 1/

Evaluation Unit	Amortization of <u>2/</u> Installation Cost	Operation and Maintenance Cost	Total
Floodwater Retarding Structures 2, 3, 4, and 8	34,320	1,140	35,460
Fish and Wildlife Small Mouth Bass Stream Improvement	3,640	1,970 <u>3/</u>	5,610
Project Administration	4,560		4,560
GRAND TOTAL	42,520	3,110 <u>3/</u>	45,630

1/ Price Base: Installation Costs 1972, Adjusted Normalized Prices  
for Operation and Maintenance Costs

2/ 100 years @ 5½ percent interest

3/ Includes \$1,270 for replacement of stream improvement devices.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

First Capitol Watershed, Wisconsin

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Within the Watershed			
Crop and Pasture	15,740	5,910	9,830
Other Agricultural	6,180	1,630	4,550
Nonagricultural			
Road and Bridge	9,720	2,810	6,910
Outside the Watershed			
Crop and Pasture			4,690
Rural Property			1,800
Urban			15,450
Indirect	4,140	1,320	2,820
TOTAL	35,780	11,670	46,050

1/ Adjusted Normalized Prices for agricultural damages and current prices for nonagricultural damages.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

First Capitol Watershed, Wisconsin

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/					Average Annual Cost 3/	Benefit Cost Ratio
	Damage Reduction 2/	Changed Land Use Agr.	Fish and Wildlife	Secondary	Total		
Floodwater Retarding Structures 2, 3, 4, and 8 and Small Mouth Bass Stream Improvement	44,820	2,120	6,200	5,700	58,840	41,070	1.4
Project Administration						4,560	
GRAND TOTAL	44,820	2,120	6,200	5,700	58,840	45,630	1.3

1/ Price base same as Table 5.

2/ In addition, it is estimated that land treatment will provide flood damage benefits of \$1,230 annually.

3/ From Table 4.

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## INVESTIGATION AND ANALYSES

The following section presents information that is pertinent in supporting the conclusions of this plan. Sufficient information is included to explain the technical aspects of the plan. Generally, information such as how surveys were made, kind of maps used, technical procedures, and criteria used, are not included in this section. Such items of a routine nature are set forth in the Soil Conservation Service handbooks of Watershed Protection, Hydrology, Hydraulics, Geology and Economics, and in Soil Conservation Service memoranda.

### LAND USE AND TREATMENT

Land treatment measures to be applied on cropland and pasture areas during the project period were based on the application of procedures given in Advisory Notice W-748.

Forest land problems and treatment needs were determined from watershed investigations and from recommendations of the Wisconsin Department of Natural Resources and the U.S. Forest Service.

Cost of technical assistance for installation of the land treatment measures was based on the average work performance time for each of the individual measures to be applied. The cost of additional technical assistance to be borne by P.L. 566 funds was determined by subtracting the cost of technical assistance available within the watershed under the ongoing program from the total estimated cost of technical assistance.

The unit costs of establishing the land treatment measures was obtained by checking cost records in the area under the going program of the Lafayette County Soil and Water Conservation District, the Wisconsin Department of Natural Resources, and the Agricultural Stabilization and Conservation Service program of cost sharing. These unit costs were used in computing the cost of the accelerated land treatment program.



The individual landowners will bear the cost of application. Basic data, computations, and cropland and pasture acres to be treated are on file in the Soil Conservation Service Office, Madison, Wisconsin. Basic data for forest land are on file in the Northeastern Area - State and Private Forestry Field Office of the Forest Service, St. Paul, Minnesota.

## HYDROLOGIC INVESTIGATIONS

Hydrologic investigations were made to determine the peak flow and run-off volume characteristics, structural design hydrographs, and peak flow-frequency relationships for economic analyses.

### Basic Data

There is one stream gaging station within the watershed located on the right bank of the Pecatonica River at Darlington. Records are available since September 1939. The drainage area at the gage is 274 square miles.

Precipitation records have been kept continuously at the Weather Bureau substation in Darlington since May 1910, and during the prior period from February 1901 through September 1905. The precipitation records are published monthly in Climatological Data.

The watershed was evaluated using a partial duration, 24-hour, synthetic storm series. Point rainfall quantities for selected frequencies were obtained from Weather Bureau Technical Paper No. 40. The monthly distribution of storms was based upon data compiled for previous watershed studies in the area.

Soil and cover reconnaissance surveys were made of the watershed and curve numbers were assigned, using procedures described in Chapters 7, 8 and 9 of Part 1, Section 4, National Engineering Handbook (NEH).

The Lafayette County Soil Survey Report was used to determine soil types. The Forest Service assisted by determining the soil cover complex and hydrologic data for forested areas.

Synthetic hydrographs were developed for 55 subareas, combined at various locations and routed through the watershed using the computer and computer program described in Technical Release 20. Hydrographs were developed and routings made for present conditions and with various structural combinations.

Peak discharge values produced by the ten year rainfall event for present conditions, and by the ten year and one year events with structures were obtained. Discharge versus run-off curves were drawn, with the values established, and used to obtain discharge values for run-off at other frequencies.

Discharge frequency relationships established synthetically were compared to results obtained using procedures described in the U.S. Geological Survey publication Floods in Wisconsin, Magnitude and Frequency. Synthesized flood peaks were slightly higher (2.2%-9.4%) than those developed using the regional analysis.

Times of concentration were derived from stream channel hydraulics. Cross-sections of the stream channel were obtained by field survey at 37 locations. Bridge openings and road profiles were surveyed at 16 locations. All surveys were referenced to mean sea level datum. Procedures outlined in Chapter 15, Part 1, Section 4, NEH, were used.

### Structure Design

Floodwater detention storage for three of the floodwater retarding dams was based on the estimated run-off from a 50-year frequency storm. Detention storage for the Vinegar Branch structure was based on the estimated run-off from a 100-year frequency storm. Principles outlined in Section 4, NEH, were followed.

Flood routings for the floodwater retarding structures were accomplished using the graphical version of the mass-curve method described in Chapter 17, Part 1, Section 4, NEH.

Emergency spillway and freeboard hydrographs were computed using criteria established in Engineering Memorandum SCS-27 (Revised March 19, 1965) and the techniques described in Chapter 21, Part 1, Section 4, NEH.

A detailed study, including a water budget, was also made for the Jones Branch multiple purpose structure.



### Damage Frequency Analysis

Surveyed sections were used to represent the flood plain characteristics at 66 locations in the Watershed where stage-discharge curves were developed. Stage-discharge curves and stage-area inundated curves were determined using the computer program described in Computer Program for Project Formulation - Hydraulics.

Flood peak reductions in Darlington and on the rural flood plain of the Pecatonica River were based on data developed by the U.S. Army Corps of Engineers. Discharge values for various frequencies were obtained from the flood frequency line presented in Survey Report for Flood Control on Pecatonica River, Illinois and Wisconsin, February 1, 1962, by the U.S. Army Engineer District, Rock Island, Illinois. The frequency line was developed from measurements made at the U.S. Geological Survey gaging station in Darlington. Run-off volumes for selected flood events were established using the run-off volume-peak discharge relationship shown for the standard project flood in the Corps of Engineers report.

The run-off volumes were reservoir routed through the structures to establish the amount of run-off stored by the structures during the passage of selected events.

Peak discharge reductions at Darlington were obtained by assuming that peaks were proportional to run-off volumes. The reduced peaks were established by multiplying the discharge by the ratio of run-off, less reservoir storage to run-off.

The reduction in flood stage and flood damage that would accompany the reduction in peak discharge was determined using the stage-discharge and stage-damage curves presented in the Corps of Engineers Report.

### GEOLOGIC INVESTIGATIONS

A geologic reconnaissance survey of First Capitol Watershed was made to determine lithology, stratigraphic sequence, and general structure of the bedrock in the watershed.

The watershed is within the Driftless Area of Wisconsin. Main topographic features are mounds or hills, flat ridges, wide flood plains bounded by steep banks, and many small V-shaped valleys. The

ridges dip southward less than 20 feet per mile, probably reflecting the gentle southerly dip of the strata. Local relief from the divides to the larger streams is between 180 and 280 feet.

The bedrock is covered with a thin mantle of soil generally less than ten feet in thickness. The soils of the area are mostly derived from the weathering of the underlying bedrock. In addition, the upper soil profile includes various amounts of wind blown silt (loess). Alluvial deposits of silts, clays and silty, sandy, gravels of Recent age are found in most of the lower reaches of the larger drainage courses of the watershed.

Bedrock exposures in the watershed are of Ordovician and Silurian age.

The Prairie du Chien Group of Early Ordovician age is the oldest group of rocks exposed in the watershed. The exposures are limited to an area along the Pecatonica River. The Prairie du Chien rocks are dolomites and sandy dolomites containing algal reef structures and a fair amount of chert. The contact with the overlying Middle Ordovician St. Peter sandstone is a pronounced erosional unconformity with a relief of several hundred feet. The Prairie du Chien rocks underlie the entire watershed except for isolated areas where pre-St. Peter erosion has removed the rock. Below the Prairie du Chien is a thick sequence of Cambrian sandstones.

The overlying Middle Ordovician St. Peter sandstone is a massive cross-bedded fine to coarse grained quartz sandstone, with a one to three foot layer of green shale at the base. The upper two to three feet is ferruginous, silty, and shaley. The St. Peter sandstone, like the underlying Prairie du Chien, was only observed along the Pecatonica River and the lower reaches of tributary water courses. At Jones Branch (Site No. 9), the St. Peter was located in drill holes 19 to 21 feet below the elevation of the stream. The St. Peter is a major aquifer of the watershed.

The Middle Ordovician Platteville formation conformably overlies the St. Peter sandstone. The rock, 52 to 63 feet thick, is a dolomite or a limestone dolomite with quartz sand grains, shale and phosphatic modules at the base. The lower 20 feet of the Platteville is locally known as quarry stone because it was used extensively for building stone by the early settlers and is still quarried in the area for this and other purposes.



The Decorah formation, 33 to 40 feet thick, conformably overlies the Platteville and is composed of dolomite and limestone with variable amounts of shale. Shale content varies from thin widely spaced laminae to layers up to six inches in thickness.

The Decorah is conformably overlain by the galena dolomite. The Galena dolomite is approximately 220 feet thick, thick bedded, and is cherty in the lower one-half. The upper 35 to 40 feet is an argillaceous thin bedded dolomite.

The Maquoketa shale of Late Ordovician age is 130 feet thick and conformably overlies the Galena dolomite. The lower 30 to 40 feet is dolomitic siltstone; the upper 90 to 100 feet is clayey siltstone and thin interbedded silty dolomite. The Maquoketa shale is unconformably overlain by a small remnant of Edgewood dolomite of Early Silurian age near the top of Belmont Mound.

Geologic structures in the watershed are those caused by regional stress and those caused by subsidence in localized zones of leached rock. Structures caused by regional stress include a southward regional dip of about 20 feet per mile, small asymmetric folds, monoclines, depressions and domes, a few faults, and well formed vertical joints. The vertical joints form conjugate systems, but the type of stress which caused the systems is not known.

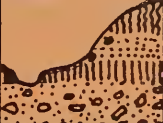
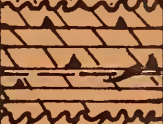




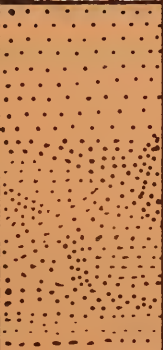
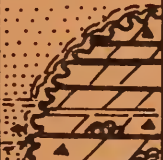
The watershed is within the zinc-lead mining district of southwestern Wisconsin. The watershed contains many old lead and zinc diggings and a few mine shafts. No active mines are known to exist within the watershed.

A stratigraphic column of First Capitol Watershed is shown on page 81. Bedrock exposures in the watershed are of Ordovician and Silurian age. All structure sites are in Middle Ordovician strata.

### **Floodwater Retarding Structures**

Preliminary site investigations indicate that all single purpose floodwater retarding structure sites are geologically feasible.

STRATIGRAPHIC COLUMN, FIRST CAPITOL WATERSHED  
LAFAYETTE COUNTY, WISCONSIN

SYSTEM	SERIES	FM	COLUMNAR SECTION	DESCRIPTION	THICKNESS Feet
Quaternary	Pleistocene-R.	-		Loess, clay chert residuum, soils, sand and gravel, some peat and muck, some clay	+40
UNCONFORMITY					
Silurian	Alexandrian	Edge-wood		Dolomite, gray, well bedded cherty, shale or clay partings outcrop at Belmont Mound only	±40
ORDOVICIAN	Cincinnati	Maquoketa		UNCONFORMITY	
				Interbedded thin dolomites and shale-silty clay	+130
	CHAMPLAINIAN	Galena		Thick sequence of dolomites. Thick to thin bedded - gray to brown. Pronounced joints and bedding planes in lower 100 ft. cherty, and thin green shales. A few fossils, mainly <u>Receptaculites</u> spp.	±215
				sites 3, 4, 5, 6, 7, and 8	
		Decorah		Interbedded limestones, dolomite, shale, fossils. site 2	± 35
		Platteville		Interbedded limestones and dolomites, shale partings, many fossils. Shale and sandy shale at base.	±70
CANADIAN		St. Peter		Sandstone - white to yellow brown quartz sand, some green shales, no fossils, massive and may be current bedded.  Site 9 Near top of St. Peter and base of Platteville.	55 to 340
	Oneota			UNCONFORMITY	
				Gray to Buff Medium to Thick Bedded dolomite, cherty, sandy, some shale	+ 40



A reconnaissance geologic survey was made at each site. Bedrock, borrow sources, emergency spillway location and other planned design and construction features were located. Field conditions that would influence design and construction costs were noted for consideration.

A foundation investigation program is needed to determine profile, lithology, and the nature of the bedrock; the thickness, characteristics, and composition of the unconsolidated earth material overlying the bedrock; and ground water levels.

Borrow resources near the dam sites are apparently adequate. Borrow area test pitting is necessary for a more accurate quantitative estimate of fill resources and to obtain samples for laboratory analyses and recommendations.

Cost of foundation and borrow investigation is included in the estimate for engineering costs under Installation Services, Table 2.

### **Jones Branch Structure**

A detailed site investigation by contract was made at the Jones Branch multiple purpose site during August and September of 1970, using a backhoe and rotary drill rig. Earth and rock samples were obtained from 17 backhoe pits and 16 drill holes, including three angle holes. Seven foundation samples were submitted to the Soil Conservation Service Soil Mechanics Laboratory at Lincoln, Nebraska.

Specific borrow areas were not sampled during foundation investigations. Samples taken in the emergency spillway area are considered representative of available core material. These samples were low to moderately plastic CL materials. Soils maps show an adequate supply of borrow materials, but additional test pitting will be done.

### **SEDIMENTATION INVESTIGATIONS**

Investigations of erosion and sedimentation were made in accordance with procedures outlined in current watershed memoranda and Technical Release No. 12 (Rev.), Procedure - Sediment Storage Requirements for Reservoirs, January 1968.

The Lafayette County Soil Survey maps, geologic maps, topographic maps, and aerial photographs and field reconnaissance were used in evaluating erosion and sedimentation. Sheet erosion in First Capitol Watershed is the principal contributor of sediment; however, stream-bank and roadside erosion are also sediment sources.

An analysis of aerial photographs and field reconnaissance indicated that gully erosion is no longer a serious problem in the watershed. Several farms have small gullies in pastured land, but these can and are being controlled by land treatment measures. In 1971 there were 17 grade stabilization structures in the watershed and 12 additional structures are planned during the project period. No evaluation studies were made as gully erosion appears to be a negligible source of sediment.

Studies completed in 1968 of roadside erosion on township, county, and state roads rank Lafayette County number 25 in linear feet of roadside erosion of 72 counties in the state of Wisconsin. The watershed road cuts and ditches are usually well vegetated with an occasional break in the cover, and some small shows of washed soils, sand, silt, and gravel in the ditches. Ninety percent of roadside erosion is on town roads.

This type of erosion is unsightly and increases highway maintenance costs, particularly on town roads. Most of the resulting sediment is trapped in road ditches and structures before it reaches the major drainage system. Quantitative estimates of roadside erosion were not made.

Channel erosion above the structure sites is variable but is generally less than 0.075 feet per year. Below the sites the rate of lateral bank cut increases, but again has a rather wide range, varying from about 0.025 to 0.12 foot per year. Several steep main channel banks may have a lateral bank cut as high as 0.15 of a foot per year. Sediment resulting from channel erosion was estimated to be about ten percent of the total sediment load in the streams.

Upland sheet erosion in the watershed is by far the most serious form of erosion in terms of tons of soil loss.



Preliminary upland sheet erosion computations were determined by the slope-practice formula modified for Cornbelt states. Data for capability classes, land use practices, and rotations were furnished by the District Conservationist of Lafayette County. Predicted storage requirements for 100 years are slightly more than 0.50 watershed inches.

A small site, No. 8 - Vinegar Branch, has a drainage area of 1,293 acres with 995 acres of cropland, 258 acres of pasture, 33 acres of roads and buildings, and a seven acre rock quarry. There are eight district cooperators with 805 acres of land, and six non-cooperators own 488 acres of land. Soil losses on cropland will be reduced from 6.1 to 3.5 tons per acre per year with planned land treatment to be installed during the project period. Sheet erosion losses on grassland and forest land are 0.4 and 0.16 tons per acre per year respectively.

For the remaining sites it is expected that soil losses from cropland will be reduced 40 percent. This would be a reduction from 5.8 to 3.5 tons of soil loss per acre per year.

Densities of watershed soils vary from 102 to 109 pounds per cubic foot. Within the reservoirs the submerged sediment will have an average density of 65 pounds per cubic foot and the aerated sediment will have an average density of 80 pounds per cubic foot.

The trap efficiency of the structures will vary from 85 percent in the structures with dry sediment pools to 96 percent in those structures with wet sediment pools. Four to 15 percent of the sediment (mostly fine sand, silt, and clay) will pass through the structures.

## ECONOMIC INVESTIGATIONS

### General

The location and extent of historic floodwater damages were determined from economic field surveys and interviews with watershed residents. Town officials and the Lafayette County Highway Commissioner provided information concerning floodwater damages to roads and bridges. The U.S. Army Corps of Engineers provided floodwater damage data for the area immediately downstream from the watershed.

Basic information such as land use, crop yields and cropping practices were obtained from interviews with farmers in the watershed and local soil conservation technicians.

Adjusted normalized prices were used to compute agricultural floodwater damages and benefits and project operation and maintenance costs. These price standards are for use in estimating deferred project effects and are outlined in the publication, Interim Price Standards For Planning and Evaluating Water and Land Resources, issued April 1966, by the Interdepartmental Staff Committee of the Water Resources Council, Washington, D.C. Current prices were used to compute road and bridge and urban floodwater damages and benefits. Current (1972) prices were used to estimate the cost of all structural and land treatment measures.

Installation costs for structural works of improvement were amortized at 5½ percent interest for a 100 year evaluation period to determine average annual costs.

### Floodwater Damages

Estimates of floodwater damages to crops and pasture were based on land use and average flood-free yields in the watershed. Present flood-free crop yields were adjusted upward to reflect increases in yields that can be expected from advanced agricultural technology.

Floodwater damage to crop and pasture land was evaluated on the basis of floodwater damage factors developed for the state of Wisconsin. Damage rates for each crop (corn, oats, hay and pasture) were determined for the 0-1 feet, 1-3 feet, and over three foot categories by months. These monthly values were weighted by the percent of annual floods which occur during each month of the growing season and totaled to determine an average annual damage rate.

Annual damage rates for corn, oats, and hay were then converted to a composite flood plain crop acre. The damage rate per composite crop acre and pasture acre in each depth category was applied to the acres inundated as computed by the hydrologist for the 100, ten, five, two, one and one-half year frequency floods. These damages were converted to average annual by developing damage-frequency of occurrence curves for the following conditions:



1. Without project
2. With land treatment measures installed
3. With land treatment and structural works of improvement installed

Other agricultural damages consisting of floodwater damage to fences, farm roads, and cost of debris removal were determined by interview. With this information the approximate damage per acre in each evaluation reach was computed. Per acre damages per reach were then applied to the area flooded calculation as determined by the hydrologist for the small, medium, and large size floods. These damages were converted to average annual through the use of damage-frequency curves.

Estimated floodwater damages to public roads and bridges were based on information from interviews and by field observations. Historic and anticipated damages by elevation and storm frequency were determined for each road and bridge location subject to floodwater damage. Average annual floodwater damages were developed by relating the estimated repair and maintenance costs from floodwater damage to stage, and stage to percent frequency of occurrence. Damages caused by the various frequency storms were plotted graphically with the area beneath the curve representing the average annual damage.

Floodwater damages along the Pecatonica River downstream from the watershed were also evaluated. Included were damages to the city of Darlington and damages to agricultural property on both sides of the Pecatonica River directly downstream from Darlington for a distance of about six miles.

The downstream floodwater damages for the years 1944, 1946, 1947, 1948, 1950, and 1960 were provided by the U.S. Army Corps of Engineers. These dollar damage figures were converted to adjusted normalized prices through the use of appropriate conversion factors. These damages were converted to average annual through the use of damage frequency curves for "without" and "with" project. The change in stage for given frequencies with project provided the benefits that are expected to result from structural works of improvement.

### Indirect Damages

Indirect damages otherwise unaccounted for in the evaluation of floodwater damages were estimated as a percentage of direct floodwater damages. Ten percent was used for agricultural losses such as the inability of farmers to readily transport crops and produce to market because of flooding. Indirect damages resulting from direct damages to public roads, bridges, and culverts were estimated at 20 percent. Examples of indirect damage to these facilities are expenses of extra travel around flooded areas, costs incurred by local and state agencies for actual traffic rerouting and high road maintenance costs from the use of detour routes not built to withstand heavy traffic. Indirect urban damages such as loss of income to commercial establishments, traffic rerouting, interruption of utility service, etc., were estimated at 15 percent of direct urban damage.

### Project Benefits

Floodwater damage reduction benefits were computed as the difference between damages without project and those remaining with project.

Benefits from land use conversion were computed on the basis of the reduction in frequency of flooding with project. Land use conversion in the watershed is applicable to land that has never been cropped due to the hazard of frequent flooding but will be put under cultivation as a result of the project. Based on level of protection, soils, market availability, and farmer interviews, it is estimated that 104 acres of land now in pasture will be converted to cropland.

Recreation benefits for the Jones Branch structure (Site 9), a proposed multiple purpose reservoir type structure for floodwater retention and recreation development was also evaluated.

### Secondary Benefits

Local secondary benefits were computed in accordance with Chapter 11 of the Economics Guide for Watershed Protection and Flood Prevention (Revised 1964). Local secondary benefits stemming from the project were estimated at ten percent of the total direct project benefits.



In addition, local secondary benefits induced by the project were considered as ten percent of the increased costs that will be incurred by farm owners and operators in connection with increased production. In this case, secondary benefits were computed for increased costs associated with increased production on land converted from pasture and idle land to cropland.

Secondary benefits from a local viewpoint have been evaluated and included in the economic justification of the project. Although secondary benefits will accrue from a national standpoint, they have neither been evaluated nor included in the benefit-cost ratio.

## **ENGINEERING INVESTIGATIONS**

### **Maps and Surveys**

United States Geological Survey 7.5 minute quadrangle maps with a contour interval of ten feet were used as base maps for planning activities. Field surveys were made to supplement the base maps.

### **Design Criteria**

All four floodwater retarding structures were designed to contain a 100-year accumulation of sediment. The principal spillway riser is designed with the low stage floodwater release at the 100-year sediment pool elevation. A slide gate will allow the pool to be operated dry, or at the 100-year sediment elevation.

The principal spillways are designed to release the flood detention volumes in less than ten days.

Hazard class "c" design criteria were used for the Vinegar Branch floodwater retarding structure. Floodwater volume from a 100-year storm event will be stored in the detention pool and slowly released through the principal spillway.

The Wood Branch and Bonner Branch floodwater retarding structures were given an "a" hazard classification. The floodwater volume from a 50-year storm will be stored and slowly released through the principal spillway at these sites. Emergency spillway dimensions and top of dam (freeboard) elevations were determined using hydrologic criteria  $(a+b/2)$ .

The Cottage Inn Branch floodwater retarding structure was given a "b" hazard classification. The floodwater volume from a 50-year storm will be stored and slowly released through the principal spillway. Emergency spillway dimensions and top of dam (freeboard) elevations were determined using "b" hydrologic criteria.

Engineering characteristics of earth embankment and foundation materials for all four floodwater retarding sites were based on published soils maps and geological field reconnaissance. Information from detailed subsurface investigations at the Jones Branch multiple purpose site (since deleted from the plan) was used to aid in the determination of foundation conditions at the floodwater retarding sites.

Structural designs were based on procedures and criteria set forth in Engineering Memorandum SCS-27, Section 4, National Engineering Handbook, Washington Technical Release 2; Wisconsin Engineering Memorandum WI-6; and applicable Wisconsin Engineering Standards.

### **Alternate Studies**

An investigation of the watershed during project formulation indicated that structural works of improvement other than flood retarding dams were not required.

About 20 potential structure sites were considered. Twelve structure sites were evaluated. A structure site above Belmont was eliminated because of high land rights costs and insufficient benefits. Another site on Bonner Branch had poor foundation conditions. Of three sites analyzed on Wood Branch, two of them could not be economically justified.

An alternate site on Vinegar Branch was abandoned because of excessive road modification and a dwelling relocation. A floodwater retarding site located on an unnamed tributary between Woods Branch and Bonner Branch could not be justified because of insufficient benefits.

Two alternate sites were considered on Jones Branch for multiple purpose flood prevention and recreation. The lower site was located about one and three quarters miles upstream from the outlet into the Pecatonica River. It has a potential for a 65 acre



recreation lake, and would control run-off from a 3.92 square mile drainage area. The local sponsors decided to abandon the site on the basis of strong opposition from state and federal fish and wildlife agencies. The recreation pool would inundate a spring and damage downstream trout habitat. The upper site was located about one quarter of a mile upstream. It has a potential for a 50 acre recreation lake and would control run-off from a 3.16 square mile drainage area. After detailed investigation, design, and cost estimates were made, the local sponsors decided to eliminate the site on the basis of an advisory referendum which showed majority opposition to the development.

### **Cost Estimates**

Unit costs used in the engineer's estimate were based primarily on costs of previous P.L. 566 contracts for flood prevention projects in Wisconsin. The State Conservation Engineer maintains an annual cost summary based on recent unit bid prices. These average unit prices are adjusted to reflect differences in site conditions which make construction easier or more difficult than in an average situation.

The cost estimate for road modification at the Vinegar Branch structure site was based on unit prices provided by the Lafayette County Highway Engineer.

Present land values were used as a basis for computing land rights costs. The local sponsors provided estimated land acquisition costs on a site-by-site basis.

Cost of operation and maintenance of the structural measures was based on experience from similar structures, and adjusted to meet local conditions.

### **Railroad Involvement**

The Chicago, Milwaukee, St. Paul and Pacific Railroad extends through the First Capitol Watershed connecting Belmont and Calamine, Wisconsin. It is a short spur line used to haul freight, notably sand and gravel.

In order to obtain the necessary drainage area control in the watershed to protect the agricultural flood plain and reduce damages in the city of Darlington, it was found desirable to construct a floodwater retarding structure that would cross the railroad approximately one and one-half miles southeast of Belmont. Inquiries by the sponsors indicated that railroad officials were in favor of abandoning the spur line. A request for abandonment is presently (June 1973) in Washington, D.C. awaiting approval from the Interstate Commerce Commission. Construction of the Bonner Branch structure is scheduled for the fourth year of the planned five year installation period. It is anticipated that abandonment will be completed well in advance of that time and that no delay in construction will occur.

### FISH AND WILDLIFE INVESTIGATIONS

In June 1967 fish and wildlife investigations were conducted by the Bureau of Sport Fisheries and Wildlife of the United States Department of the Interior in cooperation with Wisconsin Department of Natural Resources and the Soil Conservation Service.

Copies of the complete fish and wildlife report, April 16, 1970 may be obtained from the Bureau of Sport Fisheries and Wildlife office at Minneapolis, Minnesota.

In keeping with Soil Conservation Service policies concerning the conservation and development of fish and wildlife resources, the State Conservationist in June 1971 established an interagency biological team to evaluate the impact of P.L. 566 projects on forestry, fish, wildlife and other natural resources.

A comprehensive biology investigation of the impact of proposed structural measures on fish, wildlife, and forestry resources for the First Capitol Watershed was conducted in August 1971. Each proposed site was reviewed and benefited areas examined in the field. Evaluations were made, using forms developed locally and by the Lincoln Regional Technical Service Center.

Fish and wildlife habitat was inventoried for dams and spillways, a conservation pool, flood pools, benefited areas, wetlands, streams, and fishing lakes. Terrestrial habitats were classified as woods, grass, and crops. Aquatic habitats consisting of streams, wetlands, and fishing lakes were considered separately.



## -Biology-

existing habitat acreages at each site were weighted with a quality index relative to importance for fish and wildlife. Anticipated changes in habitat as a result of the watershed project were computed in a similar fashion. Final gain and loss figures are expressed in acres having the highest habitat values. The structure site, plus the benefited area, was considered as a unit.

The interagency biology team recommended stream improvement below floodwater retarding structure No. 3 on Bonner Branch to improve the small mouth bass fishery and to provide public access. Streambank protection, instream devices, and an eight rod perpetual easement for public access were proposed.

Copies of the complete biology investigation report may be obtained from the Soil Conservation Service, Madison, Wisconsin.

## RECREATION

Potential recreation sites were investigated during the project formulation. A site on Jones Branch was selected by the local sponsors with concurrence of the various state and federal agencies.

A detailed recreation plan was formulated by the local sponsors. Design data and cost estimates were determined for the dam and recreational facilities. As a result of substantial opposition to the planned recreational development, it was subsequently deleted by the sponsors.

Stream improvement recommended by the interagency biology team will provide superior small mouth bass fishing opportunities for an estimated 30 fishermen at any one time on 1.5 miles of improved stream. Maximum use will occur during weekends in the months of July and August. Use on Saturdays and Sundays during these months is expected to be 70 percent of capacity or 21 fishermen at any one time. Use at other times will be less than 70 percent of capacity.

Present use of the unimproved stream reach is estimated at 400 recreation visits per year. This low use is attributed to lack of convenient public access and the deteriorating quality

of the fishery. Estimated recreation visits with stream improvement features installed is 2,470 per year. Increased numbers of small mouth bass and public access along both sides of the stream reach contribute to the increase. Adequate off-highway parking and sanitary facilities will also attract fishermen.

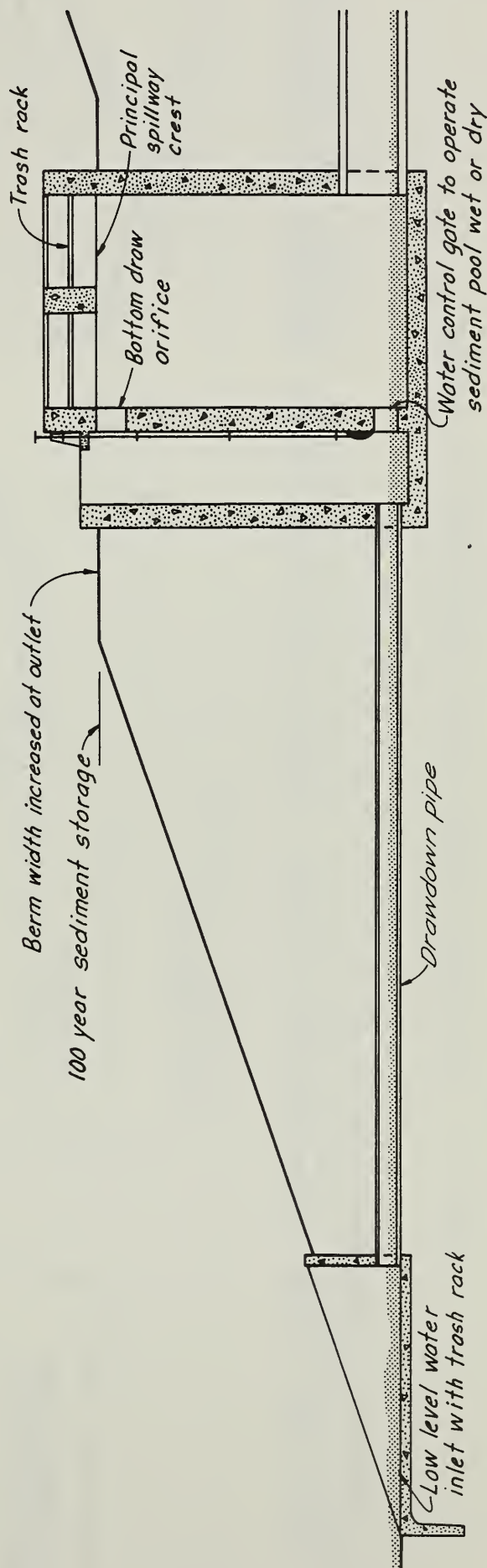
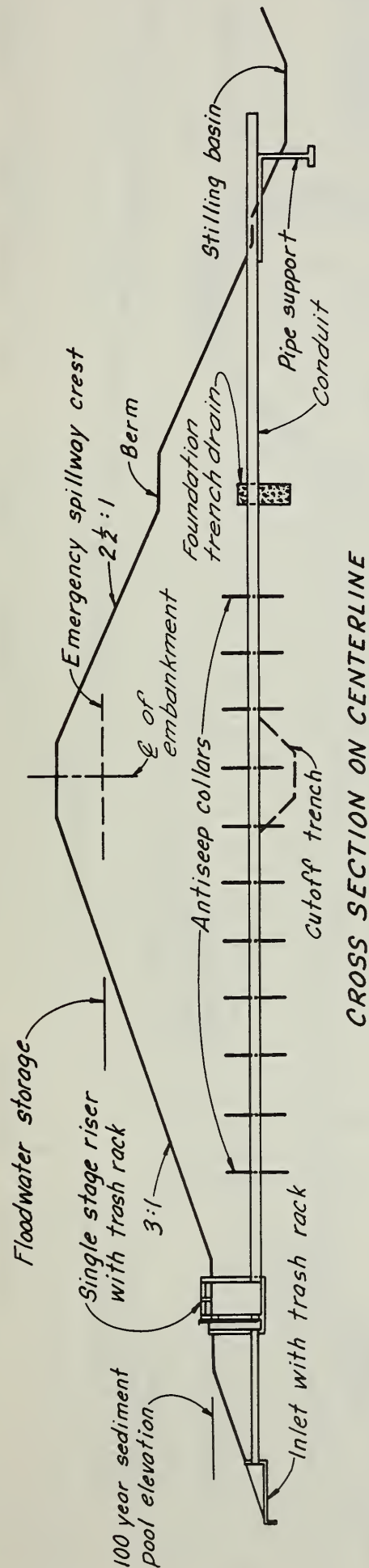
According to the Wisconsin Department of Natural Resources there are about 50,000 miles of perennial stream in Wisconsin, of which 3,500 miles contain small mouth bass. Of the 3,500 miles, about 350 to 500 miles are considered to be superior. Less than five percent (about 20 miles) of the superior small mouth bass streams have public access. Because of the limited supply and restricted access to quality small mouth bass fishing in Wisconsin, a value of \$3.00 per recreation visit was used for evaluating recreation benefits.

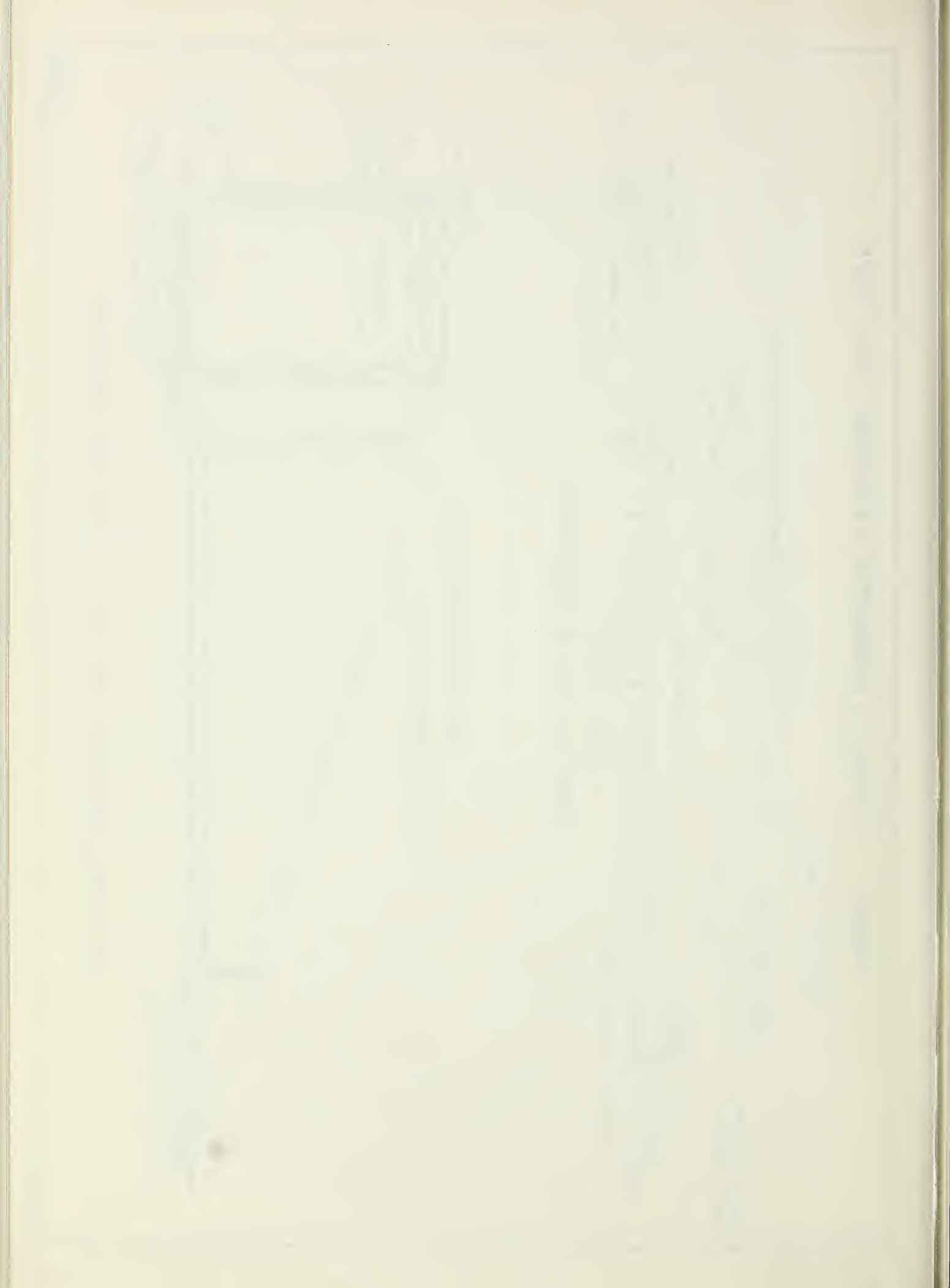
A 100-year wet sediment pool at floodwater retarding structure No. 8 on Vinegar Branch will provide incidental recreational opportunities. The pool will have an initial maximum depth of 20 feet with a surface area of 18 acres. Average depth will be five feet. Public access and minimum sanitation facilities will be provided.

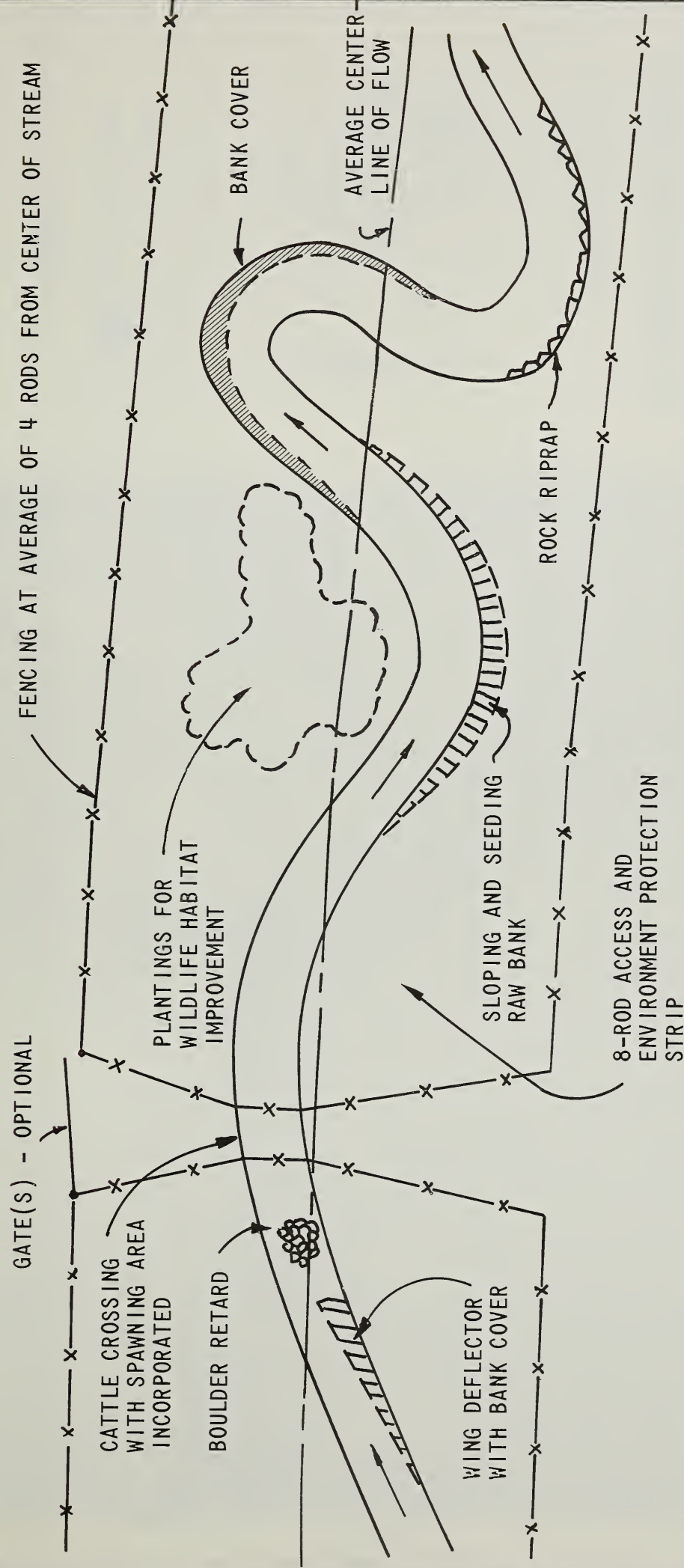




FIGURE 1 - TYPICAL FLOODWATER RETARDING STRUCTURE



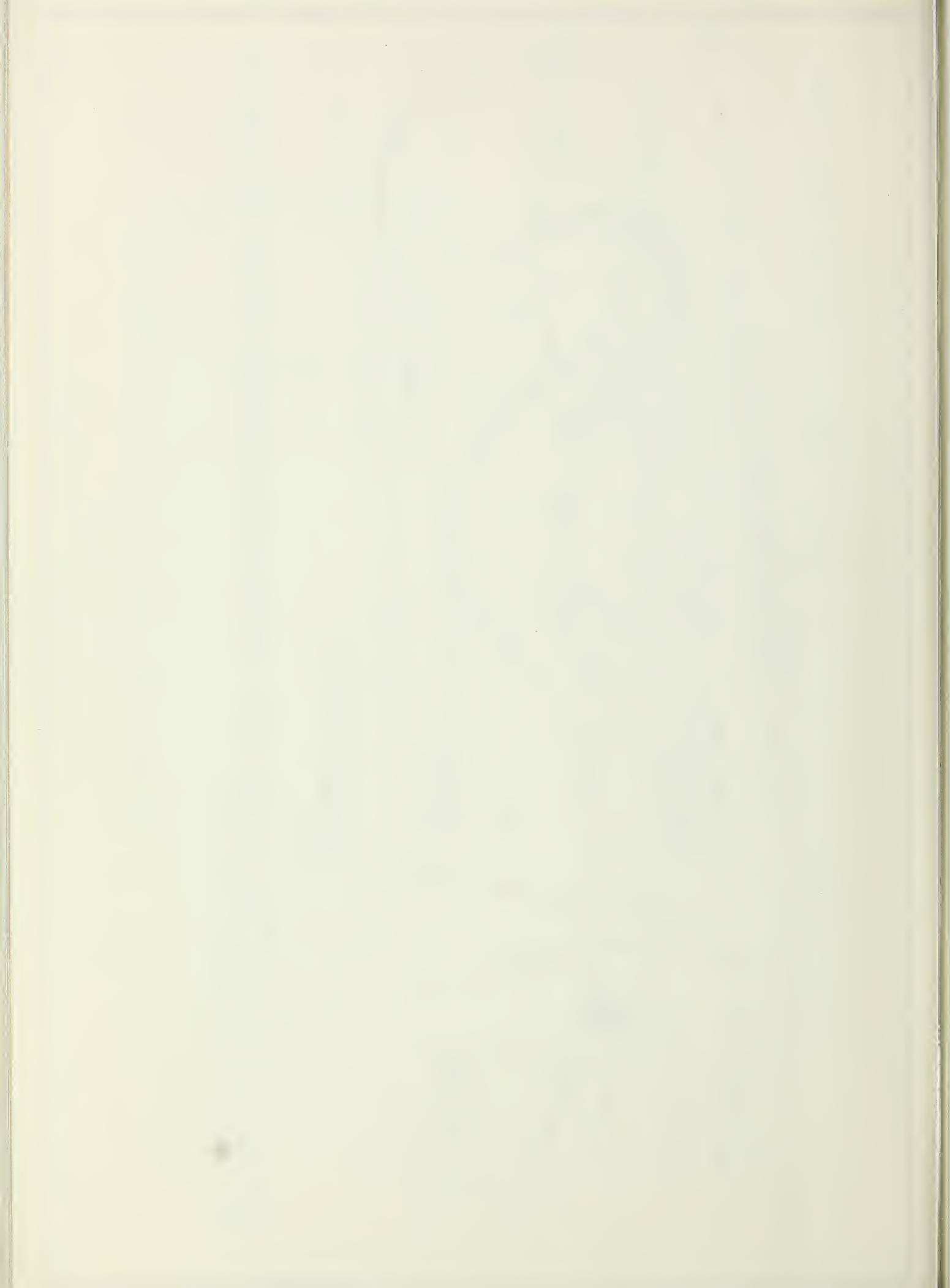




THIS SKETCH SHOWS TYPICAL STREAM IMPROVEMENT FEATURES, INCLUDING INSTREAM DEVICES FOR IMPROVEMENT OF FISH HABITAT, STREAMBANK STABILIZATION FOR IMPROVING WATER QUALITY, PLANTINGS FOR WILDLIFE HABITAT IMPROVEMENT, AND FENCING FOR PUBLIC ACCESS AND ENVIRONMENTAL PROTECTION.

FIGURE 1A - SMALLMOUTH BASS STREAM IMPROVEMENT FEATURES







LEGEND

100 YEAR FLOOD

VILLAGE LIMITS



WISCONSIN

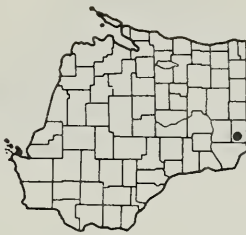


FIGURE 2

VILLAGE OF BELMONT

FLOOD DAMAGE AREAS

LAFAYETTE COUNTY

WISCONSIN

SOURCE: USDA AERIAL PHOTOGRAPHY SERIES  
WY (1968) AND INFORMATION FROM FIELD.

SCALE 500 1000 1500 FEET

APPROXIMATE

2-6-73  
5, L-31,228





APPENDIX C  
PROJECT MAP  
FIRST CAPITOL WATERSHED  
LAFAYETTE & IOWA COUNTIES, WISCONSIN

